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EMPIRICAL EVALUATION OF THE CIVIL ENGINEER CAREER PYRAMID AND CAREER GUIDANCE

THESIS

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ABSTRACT (*Maximum 200 Words*)

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This thesis follows a rigorous procedure to objectively evaluate the Air Force guidance. The guidance is translated into 24 research questions based on its main tenets. Each duty occurrence is categorized by type of position, associated MAJCOM, overseas proximity, and leadership level. The data analysis uses tests of proportion and χ^2 categorical tests to address each research question. The results suggest that officers in the data set exhibit conformance to the comprehensive career guidance and to most of the Air Force guidance tenets. However, civil engineer squadron commanders demonstrated stronger conformity than non-commanders only in the areas of progression, career broadening and education. Finally, the results are integrated with Expectancy Theory and Goal Theory to provide recommendations to improve the value of the Air Force guidance.

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THESIS

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In Partial Fulfillment of the Requirements for the

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Table of Contents

List of Figures

List of Tables

AFIT/GEE/ENV/00M-11

Abstract

Air Force civil engineer officers rely on published guidance to assist in establishing their career objectives. This thesis uses empirical data to evaluate the published Air Force career guidance. The data set is comprised of complete duty histories from all active duty lieutenant colonels in the civil engineer career field. The guidance implies a career path to become a civil engineer squadron commander but provides no empirical validation.

This thesis follows a rigorous procedure to objectively evaluate the Air Force guidance. The guidance is translated into 24 research questions based on its main tenets. Each duty occurrence is categorized by type of position, associated MAJCOM, overseas proximity, and leadership level. The data analysis uses tests of proportion and χ^2 categorical tests to address each research question. The results suggest that officers in the data set exhibit conformance to the comprehensive career guidance and to most of the Air Force guidance tenets. However, civil engineer squadron commanders demonstrated stronger conformity than non-commanders only in the areas of progression, career broadening and education. Finally, the results are integrated with Expectancy Theory and Goal Theory to provide recommendations to improve the value of the Air Force guidance.

EMPIRICAL EVALUATION OF THE CIVIL ENGINEER CAREER PATH PYRAMID AND CAREER GUIDANCE

I. Introduction

General Issue

In light of current military downsizing and restructuring, officer career progression has become increasingly perilous. Losses in manpower authorizations and reductions in military installations both stateside and overseas have dwindled the career opportunities for many Air Force officers. Current guidance is often ambiguous and contradictory, leaving commanders and career counselors to interpret and espouse its meaning without justification. The Air Force needs to substantiate its career guidance to ensure it is providing accurate and empirically grounded advice.

Background

Civil engineer officers, in particular, face a unique set of constraints. In addition to the downsizing and restructuring which has severely limited the number of authorized positions at each level, outsourcing certain civil engineer functions to contractors has pushed officer opportunities to an even smaller number of locations. Despite all of this, the need for highly competent commanders and career officers has not diminished. In the past, civil engineers have "stove-piped" within their career field accumulating standard base level experience and culminating in a civil engineer squadron commander position. Currently, civil engineer officers are being selected for other Air Force leadership positions and joint positions by virtue of their technical background and leadership

experiences. This requires civil engineer officers to broaden their experiences in preparation for such opportunities. It also depletes the available senior leadership in an already undermanned career field. Therefore, officer career development and experience is becoming more crucial to meeting future mission needs.

Current Guidance. The sources of officer career guidance are basically limited to advice from senior officers and Air Force generated documents. The Air Force has created a career guide for officers in each career field. Chapter 5 of the guide provides civil engineer officer career guidance and is included in the Appendix. This guidance outlines recommended career options with an included hierarchical job pyramid. The guidance is offered to ensure each officer has the "breadth and depth" of experience necessary to climb the ranks and some day become a civil engineer squadron commander (Air Force, undated: 5.14). Extracting the ideal duty experience from the guidance is a highly ambiguous and subjective process. Duty experience in this case refers to the job type, level, and timing for each successive duty position in an officer's career.

Factors Influencing Career Outcome. Duty history is only one of the many factors contributing to officer progression and promotion. Figure 1 graphically suggests some additional factors. In addition to duty history, the different opportunities available to an officer can affect the career outcome. Without ample opportunity for professional development and leadership experiences, an officer's career potential may be diminished. A key aspect in the screening and promotion of senior officers is long term performance in their past positions. Therefore, regardless of duty history or opportunity, performance is a critical factor in career outcome. Finally, select officers by virtue of their position and association with senior Air Force leaders are able to secure

unofficial mentorship. In other words, their close proximity to senior executives may have an effect on career outcome.

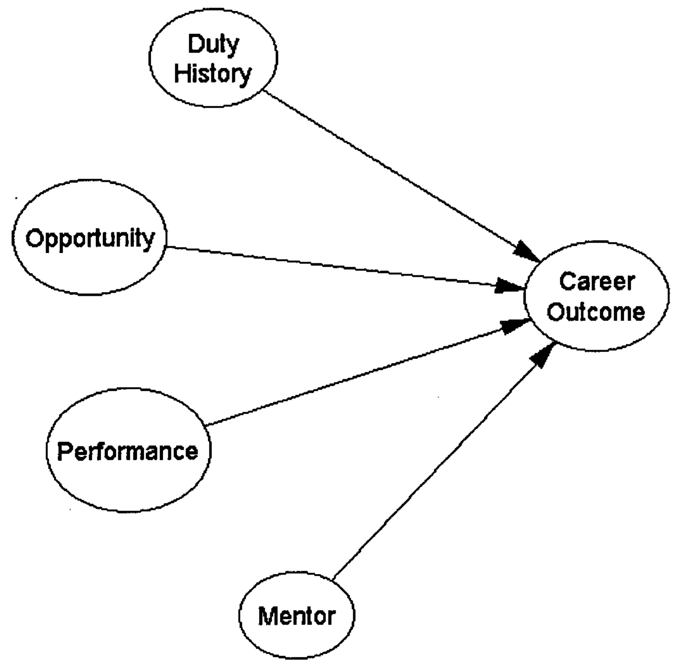


Figure 1. Factors Influencing Officer Career Outcome

Focus for Study. The focus for this research is on officer duty history since past research has suggested that it plays a significant role in the outcome of civil engineer officer careers. For example, one such study found that frequency of job assignments and job changes can affect civil engineer career outcome (Cady, 1984: 60-61). Another study found that civil engineer squadron commanders place a high value on the experience gained from their past positions in preparing them for their Base Civil Engineer responsibilities (Vroman, 1986: 47). Finally, some groups of civil engineer officers have been found to view career-broadening tours as negatively impacting their careers (Ingenloff, 1986: 62).

Therefore, this study is limited to the duty histories of an identified population of officers with a common career outcome. The duty histories are examined in relation to the accepted Air Force career guidance. The Air Force guidance states that there is no "school approved solution" for grooming officers. Instead, officers are advised to "bloom where planted and the rest should fall into place," (Air Force, undated: 5.14) emphasizing the leap of faith required to follow this guidance. This highlights the need for research on the topic of effective career experience for civil engineer officers. This analysis investigates the empirical validity of the Air Force guidance.

Problem Statement

Current Air Force civil engineer officer career guidance lacks empirical support.

Research Objectives

The objective is to evaluate the existing Air Force civil engineer officer career guidance. The first step is to obtain the data, which for this research are duty histories from a representative population of civil engineer officers. Next, the current Air Force civil engineer officer career guidance is translated into a comprehensive list of research questions. Each duty occurrence is categorized by type of position, associated MAJCOM, overseas proximity, and leadership level. The formatted data is analyzed using statistical procedures. Finally, the results of the analysis are used to evaluate the Air Force guidance and provide some recommendations based on workplace motivational theories.

Research Methodology

Procedure. The fundamental methodology for this research involves categorizing each separate duty occurrence for each officer in the population according to the coding scheme developed in Chapter 3. The coded duty histories are chronologically entered into a Microsoft Excel® spreadsheet and analyzed to evaluate the Air Force civil engineer officer career guidance.

Choice of Analysis. The formatted data used in this research is categorical in nature. Therefore, the analysis deals mainly with categorical analysis and tests of proportions. The precise method used for each research question results from the type of questions and the focus of the Air Force Guidance in that area. In this manner, the research questions are direct and the methods used to answer them are reliable, objective statistical tests and graphical presentations.

Scope of Research

This research is confined to one of the four factors presented in Figure 1: Duty History. Additionally, there are three factors further limiting the applicability of this research. First the choice of data has an impact on the choice of analysis used. Second, the data source impacts the reliability and level of information available. Finally, the manipulation of the data affects the amount of error that is introduced into the study.

Choice of Data. The objectives of this study require a sample of civil engineer officers with substantial and representative duty histories. The data must contain characteristics of career officers and of civil engineer squadron commanders since the career guidance specifically relates to a career culminating in a civil engineer squadron

commander position (Air Force, undated: 3). Additionally, the statistical methods employed require a large sample size. The logical population for this research is current, active duty, civil engineer lieutenant colonels.

Source of Data. The data for this study was gathered from an existing Air Force database maintained by the Air Force Personnel Center. The sample was limited to all lieutenant colonels with primary duty AFSC's in the civil engineer career field as of 15 September, 1999. Complete duty history information was requested for each individual. The data included the duty AFSC, duty title, organization, command, base, and state for each duty occurrence.

Limitations of Data. This study utilizes historical data to evaluate a current Air Force document. In this respect, there are serious limitations on the generalization of conclusions to the present or future. As a result, caution must be taken when using the results of this analysis to make recommendations to current civil engineer officers. The data can only portray the past situation of the officers studied and likewise, the guidance can only indicate the experience currently preferred by senior leadership. Therefore, it is important to keep in mind that recommendations for the future are highly sensitive to current conditions and policies of senior civil engineer and Air Force leadership.

Instrument. Finally, there are three reasons the data for this analysis was gathered from an existing source rather than from surveys or another measurement instrument. First, empirical data is much more reliable and credible than survey data. There are very few problems with response percentages or incomplete records. Second, using empirical data provides a more direct approach to the research. A survey of this information might yield a more subjective analysis of officer career experience. Finally, the error

introduced by human application of a survey tool or other measurement instrument is altogether avoided.

Relevance

The topic of this research is appropriate by virtue of the current state of the civil engineer career field. As the officer manning and duty opportunities become more and more scarce, the management of these resources becomes more crucial to the future of the Air Force. Accordingly, this study investigates a specific area of career management that is critical to the development of the civil engineer officer corps: duty experience. Additionally, this study is grounded in empirical data, established theory, and sound statistical analysis contributing to the credibility of the results.

Career Management. The demands placed on the civil engineer career field are taking their toll on the available pool of senior leaders. It is important that career guidance and career outcome be closely related so that the Air Force can accurately communicate the experience required to grow effective leaders and commanders. This research evaluates the overall current career guidance to include specific tenets such as breadth and depth, balance, overseas experience, MAJCOM experience, career broadening, staff positions, and officer education. The results have the potential to support or generate revisions to the existing Air Force civil engineer officer career guidance.

Outline of Thesis

This thesis contains five chapters and appropriate appendices. The chapters are in this order: Introduction, Literature Review, Methodology, Findings and Analysis, and Conclusions. These chapters are briefly described below.

Chapter 1: Introduction. This chapter discusses the background, scope and approach for the research in order to rationalize and focus the problem statement. Additionally, the research effort and direction is scoped out along with the presentation format for the thesis document.

Chapter 2: Literature Review. The second chapter introduces the Air Force Civil Engineer career field guidance and appropriate Air Force publications. Pertinent academic literature is also reviewed to construct a theoretical framework around the research. Common theories on workplace motivation are discussed and Vroom's Expectancy Theory and Goal theory are established as the most appropriate to support this research. The Air Force career guidance is referenced in Chapter 3 for the development of the research questions. The theory is used to evaluate the Air Force guidance and to focus the recommendations provided in Chapter 5.

Chapter 3: Methodology. The methodology chapter begins with the development of the research questions. The research questions translate the Air Force guidance into testable questions for analysis in Chapter 4. The latter half of the methodology chapter illustrates the categorization of the data into a manageable format. Each of the duty occurrences for each of the officers was numerically coded and entered into an Excel spreadsheet to facilitate the statistical tests performed in Chapter 4. Chapter 3 ends an explanation of the statistical tests and the associated notation referenced in Chapter 4.

Chapter 4: Findings and Analysis. The fourth chapter presents the results of the data analysis. The research questions developed in Chapter 3 are addressed and analyzed to provide an objective basis for the conclusions and recommendations made in Chapter 5. The procedures include graphical analyses, tests of proportion and χ^2 tests of categorical data.

Chapter 5: Conclusions and Recommendations. The fifth chapter translates the findings in Chapter 4 into conclusions and recommendations. The recommendations are tied back to the Air Force career guidance and reinforced by the theory developed in Chapter 2. Finally some suggestions for further research are offered.

II. Literature Review

Introduction

This chapter introduces the current published Air Force civil engineer officer career guidance with specific attention to the tenets evaluated in Chapter 3 and analyzed in Chapter 4. Additionally, this chapter looks at the management and motivation theories that influence the development of career guidance and goals.

Air Force Civil Engineer Officer Career Guidance

Officer career guidance abounds at all levels and in many forms. Informally, officers pick up advice and guidance from their peers and supervisors. Commanders may provide their own insight on career guidance clarification. Finally, there are Air Force approved documents suggesting concepts of career management. The latter is the most standard and official means of providing reliable guidance to officers. Quite possibly, much of the advice espoused by commanders and senior leaders is based on the Air Force documentation.

For civil engineers, there are two published sources for information on career guidance. The Air Force Civil Engineer Support Agency (AFCESA) maintains the *Career Field Education and Training Plan* (CFETP) for civil engineers. This is a 35-page document detailing the many aspects of working within the civil engineer career field. The alternative source is Chapter 5, Section 14 of the *Air Force Career Guide* found on the AFPC webpage (www.afpc.randolph.af.mil) as well as briefed in many Air Force short-courses. The guide is a summary and interpretation of the career advice presented in the CFETP and is included in the Appendix. Since Chapter 5, section 14 of

the *Air Force Career Guide* is the most widely distributed document of the two, it will be the focus for this research. For this thesis, any references to Air Force civil engineer officer career guidance or any derivative thereof will be to chapter 5, section 14 of the *Air Force Career Guide*.

Overall Career Guidance. This research concentrates on Chapter 5, Section 14 from the *Air Force Career Guide* because it is widely deployed and focuses primarily on career guidance. It suggests that "future Air Force leaders will be comprised of those officers who demonstrate breadth and depth in their career field, show the ability to perform in high-level staff jobs, to include joint positions, and prove their ability to lead." This ominous warning is offered to officers; the "decisions made today will impact your future." Likewise, "for selected officers, technical expertise, staff experience, and an outstanding performance record combine to prepare them for command" (Air Force, undated: 5.14.5) implying that the focus for the Air Force guidance is on grooming civil engineer squadron commanders. The guidance is careful to preface its advice with the statement that there is "no school-approved solution." Instead the advice is to "do the best you can…and the rest should fall into place." (Air Force, undated: 5.14)

Career Pyramid. Both published Air Force civil engineer officer career documents include the same Civil Engineer Career Path Pyramid. This career pyramid is in effect a recommended timeline for the appropriate types of jobs for civil engineer officers. It indicates the preferred positions for successive blocks of time. Additionally, the shape of pyramid implies that only a fraction of officers progress to each successive level. This implies that conforming to the pyramid presented somehow increases the

chances of progressing until achieving an "exceptional career" at the top of the pyramid. Figure 2 shows the complete Civil Engineer Career Path Pyramid (Air Force, undated: 1).

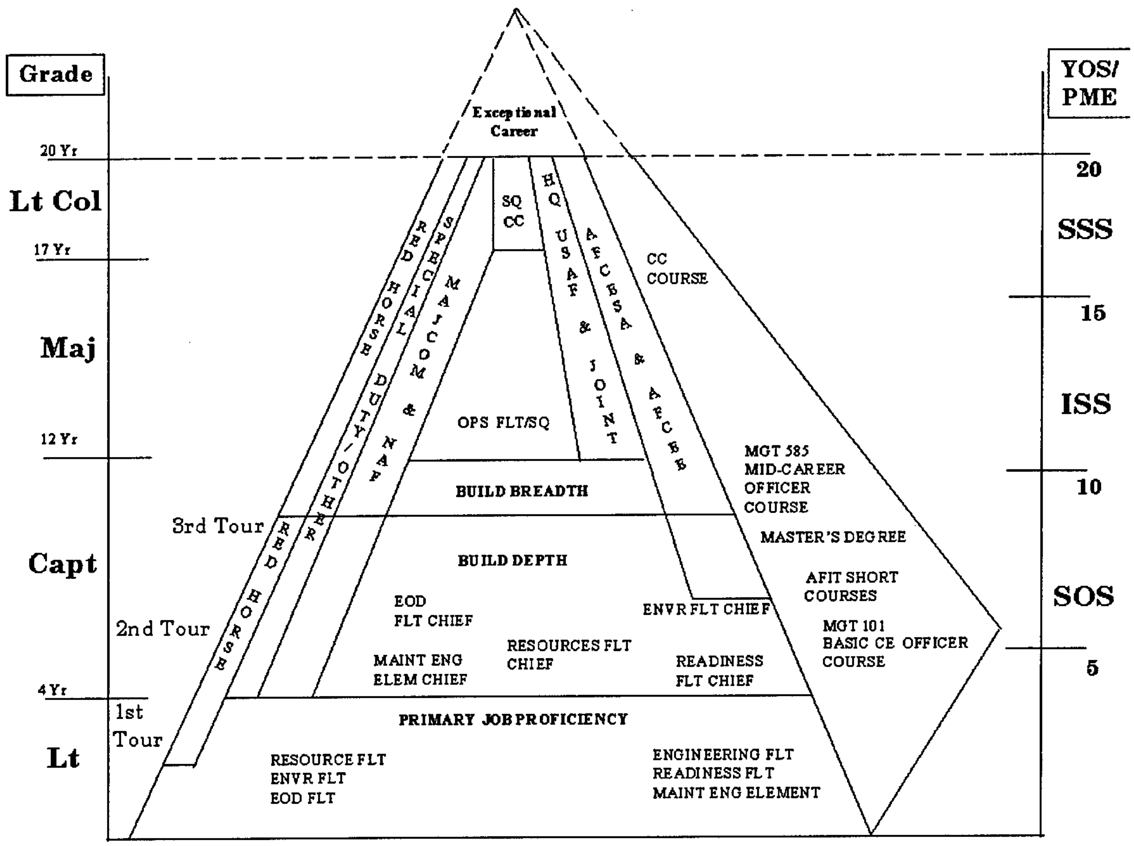


Figure 2. Civil Engineer Career Path Pyramid

Breadth and Depth. The career path guide suggests that two or three assignments are "normally required" to develop "sufficient breadth and depth". This implies that roughly the first eight years should be spent working in as many of the six flights in the objective squadron with officer authorizations. Chapter 3 provides a thorough discussion of the civil engineer squadron structure. Breadth and depth can also be obtained by working in a field operating agency, headquarters staff or by becoming a base level flight commander. These types of positions are also explained in Chapter 3. (Air Force, undated: 3)

Progression. Advancing within an organization is a cornerstone for Air Force officer development. The Air Force guidance maintains that, "progression within a specialty provides depth and increased responsibility" (Air Force, undated: 3). This applies to all aspects of an officer's career. There are different levels of leadership is all organizations and the guidance implies that officers should be striving to demonstrate a logical and incremental growth of responsibility.

Balance. The guidance recommends that an officer exhibit balance by "seeking opportunities in other parts of the organization (Air Force, undated: 2)." At base level, this means spending an appropriate amount of time in each flight. In a broader sense, this means balancing the career between major types of positions, such as base level jobs and staff level jobs.

Overseas Tour. Overseas tours are referenced by the guidance as opportunities to "quickly fill gaps in … professional development and to hone skills in a typically austere environment (Air Force, undated: 3)." Although the number of overseas opportunities has decreased recently, there are still many overseas locations that require civil engineer officers. The overseas tours referred to for this research are either short tours or long tours for which the officer demonstrates a separate duty title.

MAJCOM Experience. According to the guidance, "experience in several different MAJCOMs will" provide "a broader view of the total Air Force mission (Air Force, undated: 3)." Major Commands (MAJCOMs) serve as a headquarters in the chain of command between the operational organizations and Headquarters, Air Force. All positions will reflect a specific MAJCOM, whether it is an operational command, support command, joint command or directly reporting to the Air Staff. Officers have

opportunities to move between commands in their base level and staff level jobs throughout their career.

Career Broadening. If an officer chooses to complete a career broadening tour outside the civil engineer career field, it is suggested that they "do so early in their career in order to remain competitive for CE commander and chief of operations jobs." (Air Force, undated: 3) The opportunities for career broadening are expanding for civil engineer officers. The most commonly known tours are Reserve Officer Training Corps (ROTC) or Officer Training School (OTS) and Squadron Officer School (SOS) Staff . The guidance frowns on spending more time than necessary outside of mainstream civil engineering.

Staff Positions. According to the career guidance, the technical foundation built in the first few assignments should lead to a headquarters staff position or FOA position. There are numerous staff positions at many levels. For example, there are opportunities for officers to work at numbered air forces, Major Commands (MAJCOMs), and at the Air Staff level. Additionally, there are joint staff positions available for selected officers.

Education. Part of officer development is obtaining higher education. The educational opportunities discussed in the guidance include Professional Military Education (PME) and advanced degree education. Some officers are selected to take their PME in-residence at an Air Force or joint service institution. "Officers not afforded the opportunity to attend PME in residence should complete PME by correspondence or seminar to remain competitive in their Air Force career progression." (Air Force, undated: 5.14.4) Additionally, "Air Force Institute of Technology (AFIT) offers selected officers the opportunity to pursue advanced degrees" (Air Force, undated: 2). Officers

may also elect to obtain advanced degrees utilizing various "off-duty education programs" (Air Force, undated: 2)

Relating Air Force Guidance to Research

This research evaluates the introduced career guidance from a management perspective. There is a need for validation and potential improvement. Since the evaluation is academic in nature, the remainder of this chapter proposes motivational theory and goal theory as criterion for validating the guidance. In this respect, the theoretical framework developed in this chapter provides a basis for the conclusions and recommendations resulting from the analysis.

Theoretical Background

The theory presented in this section provides the basis for potential improvements to the Air Force guidance. This theory is used to formulate the conclusions and recommendations in Chapter 5. The following section provides a background on needs theories and workplace motivation, a description and analysis of Victor Vroom's Expectancy Theory and goal theory. Finally, these are discussed in the context of the Air Force career guidance.

Needs Theories. Organizational behavior literature is littered with theories attempting to explain and quantify the motivation and performance of people at work. Most of these theories are based on the premise that people are acting to maximize their own self-interest. Maslow's hierarchy of needs, for example, maintains that humans are motivated to satisfy lower level needs such as food and shelter before seeking to pursue higher level needs such as achievement and status (Shtogren, 1981: 77). In reality,

people tend to show motivation to satisfy higher level needs even when lower level needs have not been fully met. This concept generated the ERG (Existence, Relatedness, and Growth) theory, which essentially outlines three classifications of need. These "core needs" are all basic needs that the ERG theory suggests humans are motivated to satisfy (Robbins, 1983: 136-137).

Workplace Needs. In a workplace setting, the emphasis of needs is placed on achievement, power and affiliation. These needs are addressed under the "growth" category in the ERG theory or the esteem level in Maslow's hierarchy of needs. In either case, according to research by David McClelland, the key to motivation in the workplace is understanding these types of needs (Robbins, 1983: 137-138).

Motivational Theories. A number of popular theories have emerged which use the control of "rewards" to motivate employees and facilitate performance in the workplace. Equity theory considers an individual's perception of reward relative to their peers, while goal theory uses goal specificity and difficulty to prescribe where individual efforts are directed in the workplace. In terms of predicting the effort and performance of employees, Victor Vroom's Expectancy Theory has received attention as the most comprehensive (Robbins, 1983: 152). Vroom's theory explains employee motivation (and consequently effort and performance) in terms of the expected outcome and its associated attractiveness.

The Air Force career guidance discussed earlier in this chapter deals with goals and potentially attractive outcomes for the civil engineer officers involved. Therefore, Expectancy Theory in conjunction with goal theory appears to provide the best

theoretical context for how to evaluate the Air Force career guidance. (Robbins, 1983: 147-156).

Expectancy Theory

Since Victor Vroom's publication of Work and Motivation in 1964, Expectancy Theory has been in the forefront of Organizational Behavior workplace motivational research. The expectancy theory builds on the research and models of other behavioral scientists such as Lewin, Rotter, Peak, Davidson, Suppes and Siegal, Atkinson, and Tolman (Vroom, 1964: 14). Vroom has put together a cognitive model, which includes four main tenets: valence, instrumentality, expectancy and force. Building on the theories that humans act to maximize their own self-interests, Vroom's model uses these four concepts to explain the direction and tendency to act based upon the individuals goals and perceptions of how to achieve those goals (Robbins, 1983: 152-156). Figure 3 shows the relationship between the concepts. The underlined words indicate the Expectancy Theory model tenets to be discussed below.

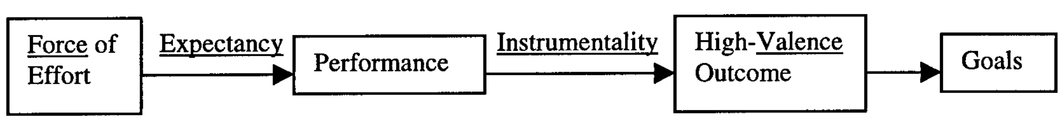


Figure 3. Expectancy Theory Diagram

Valence. The first concept, valence, refers to the individual's effective orientation toward a particular outcome (Vroom, 1964: 15). In other words, valence indicates how attractive or preferred the outcome is to the employee. For this research, a high valence outcome would be selection for a civil engineer squadron commander position. In Vroom's cognitive model, valence is a monotonically increasing function where negative

valence is associated with outcomes that are not preferred, valence is zero if the person is indifferent toward the outcome and positive valence indicates the outcome is preferred (Vroom, 1964: 17). The theory of cognitive dissonance first conceived by Leon Festinger at Stanford University also found that the valence of an outcome is affected by its inconsistency or dissonance. This suggests that people subconsciously take into account probability when assessing the valence of an outcome. Therefore increasing the probability of an attractive outcome occurring can increase its overall valence (Festinger, 1957: 1-31).

Instrumentality. The second concept, instrumentality, represents the performance to outcome association. It refers to how strongly the person feels that high performance on their part will lead to the desired outcome. In the expectancy model, this linkage between performance and organizational rewards is an important connection for the employee to make. Once the employee has identified a desired outcome with high positive valence, they must identify the behavior or performance that they believe will produce this outcome. As the likelihood of the behavior resulting in the desired outcome is reduced, the likelihood of the employee producing the behavior is accordingly reduced (Vroom, 1964: 17-18). Likewise, if the Air Force career guidance is too ambiguous about what performance or behavior produces the desired outcome, the officer is less likely to demonstrate the behavior indicated in that guidance.

Expectancy. The third concept, expectancy, is the action to outcome association. This refers to the person's perception that their effort will result in a target behavior or performance. Once the employee has identified the behavior associated with the high valence outcome, their perception of attaining that performance level is the expectancy.

As the belief in their ability of achieving this performance diminishes so does the effort put forth in attaining this performance. This is also an important link since the employee's behavior cannot be impacted if the employee does not perceive that they are able to produce the required behavior (Vroom, 1964: 17-18). If the Air Force guidance suggests behaviors that are too difficult to achieve, the officers are less likely to even attempt to exhibit these behaviors. The result is potentially poor performance.

Force. Finally, the concept of force is a function of the valence of the outcomes, and the bonds of the instrumentality and expectancy. It is the strength of the tendency to act (Robbins, 1983: 152). Specifically, if the outcome has a high positive valence, there is a belief that high performance will lead to that outcome and the person can actually achieve the target performance the force to act will be relatively strong. Conversely, if the valence is low or the person has the perception that performance does not lead to the desired outcome or that they are not able to produce the target performance level, (as well as any combination of these), the strength to act will be weak or negligible (Vroom, 1964: 18). This means that if officers perceive they will not be able to demonstrate the behaviors suggested by the Air Force guidance or that those behaviors do not lead to the desired outcome, they will not be motivated to perform well.

Implications. Vroom's Expectancy Theory is the premise for a considerable amount of empirical research but the theory also has its critics. Van Eerde and Thierry stated that the correlation between the work related criteria are not as strong as the literature indicates due to misuse of the theory. Many applications of the Expectancy theory used between subject measurements rather than the specified within subject measurements yielding poor results (Vroom, 1964: 15, Wagner, 1979: 3, Van Eerde and

Thierry, 1996: 577, and Arnold, 1981: 129). Additionally, the theory tends to fail when the possible number of high-valence outcomes becomes very large (Van Eerde and Thierry, 1996: 576).

In spite of the dissension, critics agree that when the theory is applied as originally intended and the analysis is done within-subjects, there is a valid correlation between the criterion variables and the expectancy model. The strongest correlation is between the attitudinal criterion variables (commitment, choice, intent) and expectancy (Van Eerde and Thierry, 1996: 582, and Arnold, 1981: 139-140).

Multiplicative Dispute. Some research has also found that instrumentality alone may be as good a predictor of motivation as the complete multiplicative model (Wanous, Keon, and Latack, 1983: 80-81). There may be a strong correlation between the work related criterion and the performance to reward linkage. This being the case, it is logical that strengthening this instrumentality linkage should result in strengthening the individual's force of effort and performance as well as other behavioral and attitudinal work related criterion. Ensuring that the Air Force career guidance maximizes the probability of the specified behavior resulting in the desired outcome association can improve officer effort.

Relating Expectancy with Air Force Guidance. The results of this research can then be used to strengthen the possible weak expectancy and instrumentality links in the Air Force guidance. By defining the real outcomes associated with actual officer careers and identifying the behaviors that produced these outcomes, the perception that performance leads to the desired outcome can be strengthened. The expectancy theory predicts the force or strength of the tendency to act, and supporting or improving the Air

Force career guidance may increase the performance and effort of the civil engineer officers. Additionally, the characteristics of the career milestones or goals specified by the Air Force guidance are important. The next section discusses goals in relation the expectancy theory and the Air Force guidance.

Goal Theory

This section discusses goal theory in terms of goal specificity, goal source and goal valence. A goal is whatever the individual is trying to accomplish; it is the object or aim of an action (Locke, Latham, Shaw and Saari, 1981: 126). Goals are an integral part of the Expectancy Theory because it predicts that the amount of effort directed toward a goal is a function of the valence and expectancy of the goal outcome (Roberson, 1989: 348). Expectancy Theory is also touted as being able to predict the goal commitment (Roberson, 1989: 348). It is important to understand goals and their characteristics because goals are tied so closely to expectancy theory and the Air Force guidance is really a conglomeration of goals.

Goal Specificity. Goal difficulty and specificity are associated with work-related performance and attitudinal criterion (Locke and others, 1981: 131). Studies have shown that groups assigned specific, challenging goals have demonstrated better performance than those told to "do their best" or those who were not assigned goals. Since goals "direct attention and action," (Locke and others, 1981: 131) the relationship between goal theory and expectancy theory is clearly the behavior influence mechanism.

Goal Source. The source of goals also plays an important role. Personnel who were assigned goals demonstrated higher task performance than those who were left to

create their own goals (Locke, Frederick, and Bobko, 1984: 245). This provides some insight into why it is more effective for the employers to provide career goals to budding managers or officers rather than leaving them to formulate and achieve their own personal career goals. Even in the case where company-assigned goals are impractical, some framework must be provided, otherwise employees will be unable to ascertain which behaviors result in the desired reward. Lack of such a framework can also weaken the instrumentality linkage in the Expectancy Theory. The Air Force career guidance is, in effect, a framework of goals provided by an employer.

Goal Valence. A study by Roberson indicated that increased probability of success and value has a positive relationship with goal commitment (Roberson, 1989: 362). According to the cognitive dissonance theory, both the goal value and probability contribute to increasing the valence. High goal valence and probability accordingly result in increased effort being directed toward the associated activity (Festinger, 1957: 1-31). This study also found that the increased goal commitment was positively related to behavior indicating that as the valence causes goal commitment to rise, more effort will be directed toward goal accomplishment (Roberson, 1989: 363).

Integration of Goal Theory and Expectancy Theory. As research literature indicates, applying goal theory in conjunction with Expectancy Theory provides a strong predictor of work related criterion. "Cognitive models of motivation favor expectancy-value formulation to explain individual preferences among goals" (Roberson, 1989: 348). Integrating goal theory and expectancy theory indicates that improving goal commitment and ultimately task performance requires that specific and somewhat difficult goals be assigned. Additionally, to ensure goal directed behavior is maximized, the valence is

increased not only by creating attractive outcomes but by increasing the probability of accomplishing the goals.

Integrating Theory with the Air Force Guidance

The Expectancy Theory and goal theory can relate the results of the analysis to the current Air Force career guidance. There are four theoretical concepts used by this research. First, this research considers the valence of the outcomes in terms of value to the officer and the perceived probability of achieving those outcomes. Second, this research considers the instrumentality, or the perception of whether the target behaviors result in the high valence outcomes. Third, this research considers the expectancy, or the perception of whether the target behaviors can be exhibited. Finally, this research considers whether the level of goal specificity and goal difficulty provided by the Air Force. The conclusions and recommendations in Chapter 5 discuss the Air Force guidance in the context of these four concepts. Therefore, the theory presented in this chapter provides a basis for supporting or improving the Air Force career guidance.

III. Methodology

Introduction

This chapter discusses the two operations that are critical in the evolution of this research. First, the specific research questions appropriate to the data set are developed from the Air Force civil engineer career guidance. There are ten main question topics: the Air Force career guidance focus, the overall career pyramid, breadth and depth, progression, balance, overseas tours, MAJCOM experience, career broadening tours, staff positions and officer education. Each topic section references specific Air Force guidance tenets that are used to develop the questions.

The second part of this chapter details the development of the category coding used to manage the raw data. There are four distinct categorization themes addressed: the fundamental type of duty title held, the MAJCOM worked in for each duty title, the level of leadership for each duty title, and the CONUS or overseas proximity for each duty title. This information is used to show the evolution of the data into a useful form. The end of this section discusses the types of analysis methods used to manipulate the data and answer the research questions.

Research Questions

There are two primary considerations for the development of research questions. First, an overall evaluation of the Air Force Guidance. The preliminary research questions address the career guidance as a complete and comprehensive indication of career outcome. The subsequent research questions address specific tenets of the Air

Force guidance individually. These questions are more explicit as they consider particular components out of context.

Quantifying Air Force Career Guidance. This section isolates the specific propositions of the Air Force Civil Engineer Career Guidance to be evaluated in the analysis of the thesis. In order to perform an objective evaluation, the Air Force Civil Engineer Career Guidance needs to be objectively and accurately translated into a testable premise. Since the guidance in its current form is somewhat vague, the procedure for translating the Air Force career guidance into research questions involved interviews and extensive research of Air Force documents.

Once the guidance has been properly interpreted for each major topic of evaluation, the questions are developed to provide a transition to the data analysis of Chapter 4. The results and associated recommendations provide additional specificity of job types and timing as well as identifying those jobs that have strong correlation with career outcome. Based on the theory discussed in Chapter 2, these questions and the associated analysis have the potential to provide substantial improvement of goal commitment and the expectancy theory variables for civil engineer officers.

Career Guidance Focus. "Technical expertise, staff experience and an outstanding record combine to prepare them for command." Table 1 displays the translation of this excerpt into research questions. Refer back to Chapter 2 for additional discussion and specific citations. There is an indication that the primary focus of the Civil Engineer Career Guidance is on grooming civil engineer squadron commanders. For the remaining questions, the analysis provided in Chapter 4 includes statistical tests

between the civil engineer squadron commander and non-civil engineer squadron commander populations.

Table 1. Career Guidance Focus Research Questions

AF Guidance Interpretation	Research Question
The Civil Engineer Officer Career Guidance should have a stronger association to civil engineer squadron commanders than to the non-commanders.	1. What are the population characteristics with respect to civil engineer squadron commander experience and time in service?
	2. Is there a significant difference between the commanders and non-commanders in career guidance conformity?

Overall Test of the Career Pyramid. "Future Air Force Leaders will be comprised of those officers who demonstrate breadth and depth in their career field, show the ability to perform in high level staff jobs, to include joint positions, and prove their ability to lead." Refer back to Chapter 2 for additional discussion and specific citations. The career path pyramid presented in career pyramid (Figure 2) has been modeled as a strategy generation table is Table 2. Table 3 is the translation of the Air Force career guidance and the career pyramid into appropriate research questions. For each time interval implied by the career pyramid, the appropriate positions were identified. For example under the first time interval (0-4 years) an officer demonstrates conformance by holding at least one position in a base level civil engineer flight or in a RED HORSE squadron at any time during the time interval.

Table 2. Career Pyramid Model

Years 0-4	Years >4-8	Years >8-12	Years >12-17	Years >17-20
Base Level Flight	Flight Commander	Flight Commander	Ops Commander	CES Commander
RED HORSE	RED HORSE	RED HORSE	RED HORSE	RED HORSE
	AFCESA	AFCESA	AFCESA	AFCESA
	AFCEE	AFCEE	AFCEE	AFCEE
	NAF Staff	NAF Staff	NAF Staff	NAF Staff
	MAJCOM Staff	MAJCOM Staff	MAJCOM Staff	MAJCOM Staff
	Career Broadening		Air Staff	Air Staff
			Joint Tour	Joint Tour

Table 3. Overall Test of Career Pyramid Research Questions

AF Guidance Interpretation	Research Question
CE Officers should demonstrate a strong conformity to the Air Force CE Officer Career Guidance	3. What proportion of officers conform to the current Air Force career guidance?

In this particular case, the career pyramid (as modeled in Table 2) will be used as a standard of whether civil engineer officers are demonstrating overall conformity to the Air Force career guidance. This question is very broad in the sense that it is testing the entire career pyramid as a comprehensive entity.

Breadth and Depth. The Air Force Career Guide states: "Future Air Force leaders will be…those officers who demonstrate breadth and depth in their career field…" "When initially assigned to civil engineering, [officers] are expected to build depth through technical experience…" "Breadth and depth can be gained by…assignment to a Headquarters or field operating agency." Refer back to Chapter 2 for additional discussion and specific citations. Table 4 displays the translation of these excerpts into research questions.

Table 4. Breadth and Depth Research Questions

AF Guidance Interpretation	Research Question
Officers should experience as many different base level flights as possible in their first eight years of service.	4. What proportion of CE officers start their career in a base level CE flight?
	5. What number of flights have officers worked in during the first 8 years of service?
	6. What proportion of officers have worked in each base level flight category during the first 8 years of service?
Officers should hold a base level flight commander position during the 4 to 10 year point	7. What proportion of officers have been base level flight commanders during the 4 to 10 year point?
Officers should work in a FOA or headquarters staff position during the 6 to 12 year point	8. What proportion of officers have worked in a FOA (CE type or other) or a headquarters staff during the 6 to 12 year point?

The Air Force civil engineer officer career guidance suggests that officers should have some degree of experience in the flights of a typical civil engineer squadron. Refer to the latter half of this chapter for a more in-depth discussion on the base level civil engineer organization. Flight commander positions should occur between the four and ten year point. Finally, the guidance suggests that each officer should have a headquarters staff job or field operation agency job between the six and twelve year point in their career.

Progression. "Progression within a specialty provides depth and increased responsibility—such as moving from environmental officer to chief of the environmental flight." Refer back to Chapter 2 for additional discussion and specific citations. There are many opportunities for progression within the civil engineer career field in terms of progressing from a flight member to a flight commander or from a branch chief to a division chief. The sponsorship of this thesis has expressed an interest in a specific example of progression. Table 5 displays the translation of this interest into a research question.

Table 5. Progression Research Questions

AF Guidance Interpretation	Research Question
Officers should demonstrate progression by holding the chief of operations position before becoming a civil engineer squadron commander.	9. What proportion of officers have held a chief of operations position before progressing to a civil engineer squadron commander position?

This research question rests on the premise that an officer needs to demonstrate aptitude in a chief of operations position before being selected as a civil engineer squadron commander. According to the Expectancy Theory, one would expect that

officers with operations flight commander experience would have a higher probability of progressing to a squadron commander position.

Balance. "A balanced approach to professional development—if you spent the past several years assigned to an engineering flight, then seek opportunities in another part of the organization." Refer back to Chapter 2 for additional discussion and specific citations. Table 6 displays the translation of this excerpt into research questions.

Table 6. Balance Research Questions

AF Guidance Interpretation	Research Question
Officers should spend a proportional amount of time in each of the flights they work in during the first 8 years of service.	10. How much time have officers spent in each of the base level CE flights. Is the time spent in each flight category proportional to the core officer authorizations in those flights?
Officers should demonstrate balance of time between the base level and staff level positions.	11. How much time have officers spent in each type of job? Is the time spent in base level and staff level positions equally balanced?

The guidance suggests that officers should be spending a proportional amount of time in each flight which they work. This proportion should be relative to the number of officer authorizations in each flight. For example, the engineering/environmental flight has twice as many core officer positions as the operations flight. Officers should also demonstrate balance in their overall career by spending proportionate time in base level assignments and staff level assignments.

Overseas Tours. Overseas tours provides officers additional opportunities for, "professional development and ..honing skills…" Refer back to Chapter 2 for additional discussion and specific citations. Table 7 displays the translation of this excerpt into research questions.

Table 7. Overseas Tour Research Questions

AF Guidance Interpretation	Research Question
Officers should have at least one overseas tour during their career.	12. What proportion of officers have had at least one overseas tour?
	13. How much time have officers spent overseas?

The guidance implies officers should spend at least one tour overseas during their career. The particular aspects investigated for this major topic are the proportions of officers with overseas tours and how much time officers have spent overseas in their career.

MAJCOM Experience. Each duty occurrence is associated with a specific MAJCOM. Therefore, base level and staff level assignments may be differentiated by the MAJCOM connected with that position. "...experience in several different MAJCOMs will give you a broader view of the total Air Force mission..." Refer back to Chapter 2 for additional discussion and specific citations. Table 8 displays the translation of this excerpt into research questions.

Table 8. MAJCOM Experience Research Questions

AF Guidance Interpretation	Research Question
Officers should work in as many different MAJCOMs as possible during their career	14. How many MAJCOMs have officers worked in?
	15. What proportion of time have officers spent in each MAJCOM
	16. What is the proportion of officers that have worked within each MAJCOM?

This implies that the extent of MAJCOM experience is important to a career. The data evaluation techniques used in this research have the capability to evaluate the number and type of the MAJCOMs in which each officer in the population has worked. Additionally, the time spent in each MAJCOM is evaluated.

Career Broadening. "There are limited positions a mid-to senior- level captain can choose outside the civil engineer career field…" Moreover, "Officers who choose to cross-flow should do so early in their career in order to remain competitive for civil engineer commander and operations commander jobs." Refer back to Chapter 2 for additional discussion and specific citations. Table 9 displays the translation of this excerpt into research questions.

Table 9. Career Broadening Tours Research Questions

AF Guidance Interpretation	Research Question
Officers who intend to complete a career broadening tour should do so between the 4 and 8 year point.	17. What proportion of officers have completed a career broadening tour?
	18. Of the officers that have completed a career broadening tour, what proportion have done so during the 4 and 8 year point?
	19. What is the proportion of officers with each career broadening type?

There is a proportion of officers who have completed a career broadening tour and the guidance suggests that most of these should have taken place when the officer was a junior captain, preferably in the four to eight year point of the officers' career.

Staff Positions. "Staff billets…for civil engineering officers are prevalent at Air Staff and the FOAs, in every major command; and many joint service agencies" (Air Force, undated: 3). Refer back to Chapter 2 for additional discussion and specific citations. Table 10 displays the translation of this excerpt into research questions.

Table 10. Staff Level Positions Research Questions

AF Guidance Interpretation	Research Question
Staff jobs are critical to CE officer career outcome.	20. What proportion of officers have had a staff tour?
	21. What is proportion of officers within each staff category?
	22. How long have officers remained in staff positions?

The guidance implies that staff level work has some impact on the outcome of civil engineer officer careers. These research questions will investigate the proportions of officers having held common staff positions throughout their career. The type and time spent in these positions will also be addressed.

Education. The "Air Force Institute of Technology (AFIT) offers selected officers the opportunity to pursue advanced degrees...Officers...should complete PME...to remain competitive in their Air Force career progression." Refer back to Chapter 2 for additional discussion and specific citations. Table 11 displays the translation of this excerpt into research questions.

Table 11. Education Research Questions

AF Guidance Interpretation	Research Question
Academic and PME education is critical to CE officer career outcome.	23. What proportion of officers have completed an advance academic degree?
	24. What proportion of officers have completed in-residence ACSC?

The guidance implies that academic and Professional Military Education (PME) have an influence on career outcome. In the analysis, this research question was limited to in-residence advanced academic degrees because off-duty education was not reflected in the duty histories. Air Command and Staff College (ACSC) will be studied because the in-residence attendance percentages for Squadron Officer School (SOS) are less consistent over time. Many of the officers studied have not yet had the opportunity to compete for in-residence Air War College (AWC).

Categorizing the Duty Titles

With the research questions fully developed, this research turns to the process of formatting the data to facilitate addressing each of the questions. The remainder of this chapter deals with the categorization of the duty titles to accomplish this task. First, the data in its raw form is presented. Then the four categorizations: type of position, MAJCOM experience, leadership experience, and overseas tours, are discussed culminating in reformatted data for each theme. Finally, the methods to be used to manipulate the data in chapter 4 are introduced.

Making Sense of the Data

The data for this study was obtained from an Air Force personnel database. It includes specific information on each duty occurrence for each officer requested. The duty Air Force specialty code (DAFSC), duty title, unit, installation, command (Cmd), location and start date for each duty occurrence were obtained. Table 12 presents a sample of this data in its original form.

No.	DAFSC	Duty Title	Unit	Installation	Cmd	Location	Start Date
1	5521C	ENVIRONMENTAL PROGRAM PLANNER	CIVIL ENGINEER SQ	MAXWELL	ATC	AL	820616
2	5525E	ELEC ENGRG DSGN AND PROJ OFF	RED HORSE SQ	YUMJ	AFE	UNKIN	840525
3	32E4	PROGRAM MGR, BASES & UNITS BR	AIR EDUC AND TRNG CMD	RANDOLPH	AET	TX	970101
4	0940	ASST PROFESSOR AERO STUDIES	AIR FORCE ROTC CORP	MQEJ	ATC	IN	891206
5	5525C	STU PHD CE STRUCTURES	AF INST OF TECH INST	AQMM	AUN	GA	860918
6	T5525G	ASST PROFESSOR OF ARCHITECTURE	AF INST OF TECH INST	WRIGHT PATT	AUN	OH	840709
7	5525G	DEPUTY BASE CIVIL ENGINEER	*** **	DATA MASKED	SYS	UNKWN	861217
8	1825L	MISSILE COMBAT CREW COMMANDER	STRATEGIC MISSILE SQ	MALMSTROM	SAC	MT	781212

Table 12. Raw Data Sample

To facilitate analysis, the data required extensive formatting. For this research, the data was entered into an Excel spreadsheet for ease of manipulation. Numerical codes were developed for each category used in the analysis. Each duty occurrence was

coded according to its characteristics. Four distinct spreadsheets were fabricated, each presenting a particular aspect of the data: type of job, MAJCOM experience, leadership experience and overseas tours. Integrating this categorization with the inclusive dates for each duty title enabled the analysis to consider timing of each duty occurrence.

The process of categorization can be a subjective process because the burden is on the analyst to independently consider each title occurrence and assign a code. Since this step is critical to the study, the documentation and research contributing to the development and assignment of categories is presented in detail.

The Process. The categorization process is driven by the nature of the research questions and by the analysis techniques. After each duty occurrence was assigned a code the data was reduced to four numerical codes (one for each categorization theme) for each duty occurrence. Therefore, the data in its revised form describes the career progression for each officer as a numerical code in the space of time. The resulting spreadsheet includes both the time and category code for each duty title occurrence for each officer. Example spreadsheets are presented later on in this chapter to clarify this procedure.

Each officer's career spans more than 15 years and therefore, the categories applied to the data must be generalized over time. This warrants extensive research on current and past structures of the Air Force and all types of units considered in this analysis. In order to make the categories general in nature, strong mutually exclusive equivalence between historical Air Force organizational structures were identified.

The next four sections present the final category codes and explain the rationale behind the codes chosen. The development of the category codes was accomplished

through interviews and documentation of Air Force publications, and historical literature. The reason for providing such detail on this aspect of the study is to ensure confidence in the validity of the categories as adequate generalizations and as useful resolutions.

Type of Position

This categorization theme indicates the type of position associated with the duty occurrence. There are eight major categories and a varying number of sub-categories within each broad category. The major categories as discussed below are: base level, RED HORSE, staff level, career broadening, student, instructor, specialized mission and other career.

Base Level Categories. All instances of duties occurring at an operating base or smaller scale installation were afforded a distinct set of categories. Table 13 indicates codes used for the base level categorization.

Table 13. Base Level Categories

101	Engineering/Environmental Flight
102	Operations Flight
103	Resources Flight
104	Readiness Flight
105	Explosive Ordnance Disposal Flight
106	Tenant Type Civil Engineer Unit Position
107	Training Unit Position
108	Civil Engineer Section Commander
109	Chief of Operations Flight
110	Deputy Civil Engineer Squadron Commander
111	Civil Engineer Squadron Commander
112	Deputy Group Commander
113	Group Commander
114	Base Civil Engineer (Non Commander type)
115	Training Unit Commander
116	Other Civil Engineer Type Position

There are sixteen categories ranging from civil engineer flight positions to group commanders within the base level structure. The numerical code associated with each category is the number assigned to the duty occurrence. For example, the first duty occurrence in Table 12 would be coded as "101" in this spreadsheet. The documentation supporting these categories is presented below.

The careers of the officers in the data set range from 16 to 26 years. This timeframe that has seen many changes in the civil engineer squadron structure. The squadron structure in the 1980's was primarily governed by Air Force Regulation 26-2. Figure 4 provides the organizational structure prevalent at that time. (Department of the Air Force, 1982: A3)

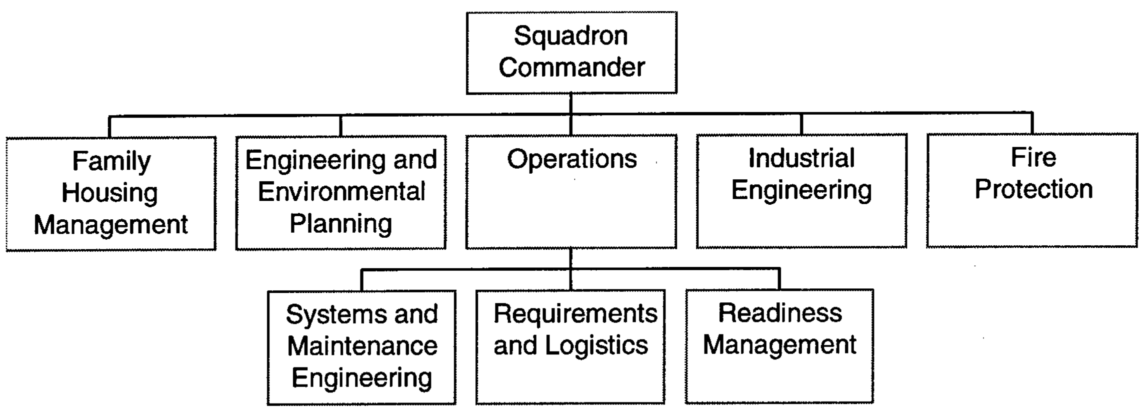


Figure 4. Old Civil Engineering Squadron Structure

In 1991, the Air Force structure changed and the resulting streamlined structure impacted the civil engineering squadron (AFPD 38-1, 1996: 1). A-Gram 96-16 and Air Force Instruction 38-101 specify the squadron structure (Figure 5) found today (A-Gram 96-16, 1996: 1 and AFI 38-101, 1998: 36). Note, there are normally no officer positions authorized in the housing and fire protection flights.

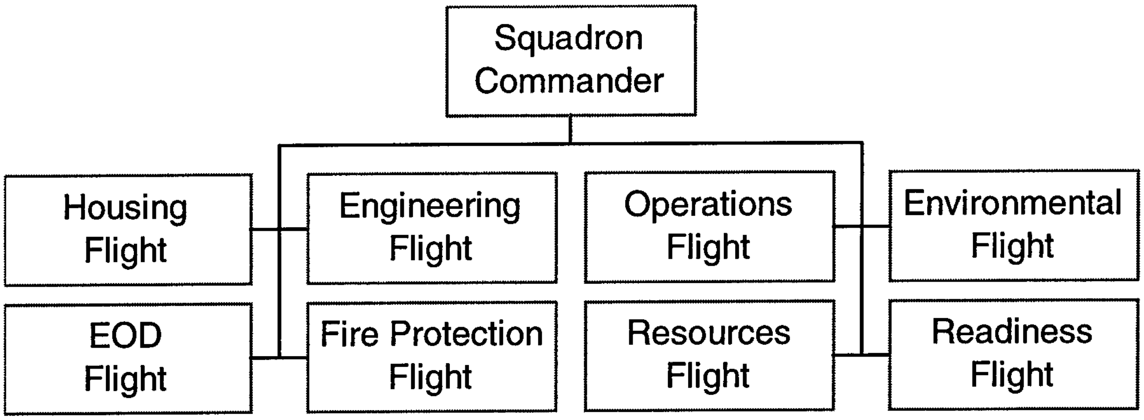


Figure 5. Current Civil Engineer Squadron Structure

To generalize the categories, the old and new civil engineer organizational structures are compared. The operations flight (or branch), readiness flight (or branch) and engineering flight (or branch) are present in both structures. Jobs within the old operations structure such as requirements, logistics, production control and maintenance were assigned to the operations category for this research. What is now known as the environmental flight was previously part of the engineering flight and the data available makes it difficult to shred out the environmental jobs from the primarily engineering jobs. Duties associated with engineering or environmental work comprise one category for this research effort. Additionally, some of the service contract work now being accomplished by the operations flight used to fall under the engineering flight. Therefore, job titles pertaining to service contract work were considered in the engineering/environmental flight category because the service and construction contracts were previously integrated in the engineering flight.

The readiness flight was allotted a separate category; although, it is important to realize that some readiness functions are new to the civil engineer mission. For example, officers demonstrating experience in the area of disaster preparedness were previously a

separate career field reporting directly to the installation commander. Consequently, some officers with duties categorized in the readiness flight may not have further breadth of experience in flight level civil engineering.

Figures 4 and 5 demonstrate that the base level civil engineer structure has changed considerably. For example, industrial engineering no longer is part of the civil engineer squadron structure. Since many of the industrial engineering functions can now be found in the resources flight, it is included in the resources flight category and likewise with other resource flight functions such as financial management. The final flight, which normally contains an officer authorization, is the explosive ordnance disposal (EOD) flight. Since this flight is relatively new to the civil engineer squadron structure, the officers demonstrating this experience while serving as a munitions officer in the past are reflected in this category. These officers were not considered Civil Engineers until recently, and it is important to note that their experience do not indicate any broadness in flight experience.

There are a number of commander positions a civil engineer officer may fill at base level. Civil engineer officers may serve as a civil engineer squadron section commander depending on their rank and experience. Operations flight commander is allocated its own category since the operations flight is such a significant flight. The civil engineer squadron commander is the top position within base level civil engineering at most installations. The deputy base civil engineer may also be military. Some officers in the data set held deputy group commander or group commander positions as well.

There are many unusual civil engineer positions at select locations. For example, officers can fill billets functioning as a civil engineer officer associated with a tenant unit

such as a laboratory or remotely located installation. These were coded as 106. There are civil engineer squadrons, which specialize in training and afford officers a different flavor of base level experience and even squadron commander opportunities. For example, the civil engineer training squadrons at Goodfellow Air Force Base offer officer opportunities outside mainstream base level civil engineering. These were coded as either 107 or 115. Finally, there are a small number of base level civil engineering duty titles that are either extremely obscure or unable to be categorized, either due to the rarity of the position or non-descriptive duty title. These were coded as 116.

RED HORSE Categories. A Rapid Engineer Deployable Heavy Operational Repair Squadron, Engineer (RED HORSE) unit is a "highly mobile civil engineer response force, supporting contingency and special operations throughout the world." They are self sufficient and capable of rapid response and independent operations in remote, high threat environments. The RED HORSE categories are presented in Table 14. (Department of the Air Force, 1998:14)

Table 14. RED HORSE Categories

201	Project Engineer
202	Chief of Engineering
203	Readiness Engineer
204	Operations Engineer
205	Chief of Operations
206	Section Commander
207	Deputy Squadron Commander
208	Squadron Commander
209	Small Detachment Position

The standard civil engineer RED HORSE unit has been preserved over the past two decades as a purely operational structure. The categories can therefore be

generalized across the entire time span for this study. The civil engineer portion of the RED HORSE squadron structure is shown in Figure 6.

There are three basic flights officers may have experienced: engineering, operations and readiness. The engineering and operations flights contain the most officer authorizations with positions such as project engineers, operations officers and the chiefs of the three respective flights. Civil engineer officers may also become the section commander, deputy squadron commander or squadron commander for a RED HORSE unit. Finally, small flight-sized RED HORSE detachments have existed at some installations. The second duty occurrence in Table 12 would be coded as 201.

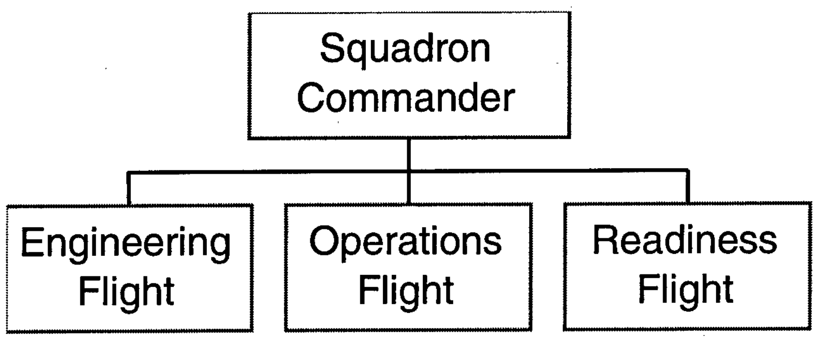


Figure 6. RED HORSE Squadron Structure

Staff Level Categories. There are many staff level positions available for civil engineer officers. The categories used for this analysis are shown in Table 15. The list of staff level categories was compiled using historical Air Force records and literature. The most common and traditional staff positions include Headquarters Air Force, MAJCOM, Field Operating Agency (FOA) (previously a Separate Operating Agency or SOA), Numbered Air Force and Division. The MAJCOM positions are broken down into operational commands and support commands. As an example, operational

commands include Air Combat Command (ACC) and Air Mobility Command (AMC) today and Strategic Air Command (SAC) and Tactical Air Command (TAC) in the past. Alternatively, support commands include Air Education and Training Command (AETC) and Air Force Materiel Command (AFMC) today and Air Force Logistics Command (AFLC) and Air Force Systems Command (AFSC) in the past.

Table 15. Staff Categories

301	Office of Secretary of Defense
302	Headquarters, Air Force
303	Operational MAJCOM
304	Support MAJCOM
305	FOA/SOA
306	AFCESA
307	AFCEE
308	Direct Reporting Unit
309	Numbered Air Force
310	Division/Region
311	Wing/Area
312	Center
313	Group
314	Laboratory
315	Detachment
316	Air Force Element/Joint/Unified
317	Miscellaneous Organization

A more detailed discussion of these commands is included in the MAJCOM resolution section. Additionally, there are many FOA's that have existed throughout the past 20 years of Air Force History. This analysis is concerned primarily with the Air Force Civil Engineer and Support Agency (AFCESA) and the Air Force Center for Environmental Excellence (AFCEE), which have large Civil Engineer officer authorizations. Other types of FOAs are not specifically identified in the categorization.

The remaining staff categories are explained as follows. Some officers have the opportunity to serve as a staff member in the Office of the Secretary of Defense. A

Direct Reporting Unit (DRU) is a unit that reports directly to the Air Force Chief of Staff. Positions where the officers in the data set are working with other services or the services of other countries were denoted as separate Air Force Element (AFELM)/Joint/Unified category. Positions specially indicating Wing or Group staffs are also denoted. Finally, positions at centers, laboratories, detachments and other miscellaneous units throughout the Air Force are included in the staff level categories since they have more characteristics of a staff position than a base level position. For example, the third duty occurrence in Table 12 would be coded as 304.

Career Broadening Categories. There are opportunities for civil engineer officers to work outside the career field for one or two tours. The most commonly reference career broadening opportunities are training officers in ROTC, SOS or OTS. Additional options are as commanders in non-civil engineer units as well as a wide-range of other endeavors such as base level wing command post officers or recruiting officers. Table 16 provides the four career broadening categories.

Table 16. Career Broadening Categories

401	Reserve Officer Training Corps
402	Officer Training School
403	Non-Civil Engineer Commander
404	Other

The duty occurrences are not specifically denoted as career broadening or not making it very difficult to identify them. For this reason, duty positions involving a temporary change in duty AFSC outside of the civil engineer career field were coded as a career broadening position. For example, the fourth duty occurrence in Table 12 would be coded as 401.

Student Categories. Civil engineer officers may also be full time students in advanced academic degree programs as well as in professional military education (PME). Table 17 shows the student categories used in this research.

Table 17. Student Categories

501	Squadron Officer School Student
502	Air Command and Staff College Student
503	Air War College Student
504	Masters Degree Student
505	Doctoral Student
506	Joint Air Command Staff College Student
507	Joint Air War College Student
508	Other Student

There are many educational opportunities for civil engineer officers however, only in-residence education could be identified in the data set. The PME schools present in the data are Squadron Officer School, Air Command and Staff College and Air War College. Additionally, officers may have completed their PME at a joint service institution. Finally, officers may obtain either a masters degree or doctor of philosophy degree through the Air Force Institute of Technology (AFIT). For example, the fifth duty occurrence in Table 12 would be coded as 505.

Instructor Categories. Qualified instructors are needed at various institutions within the Air Force. Table 18 shows the instructor categories for this research.

Table 18. Instructor Categories

601	Air Force Academy Instructor
602	Air Force Institute of Technology Instructor
603	Professional Military Education Instructor

There are three basic locations for instructor tours: the Air Force Institute of Technology, Air University and the Air Force Academy. Instructors at AFIT may have

either taught at the Civil Engineer and Services School or in the Department of Engineering Graduate Program. The data did not easily lend itself to accurately distinguishing between the two, making it difficult to determine if the officer was teaching instructional short courses or graduate level classes and research. Instructors may also be involved in professional military education at Air University or may teach undergraduate education at the Air Force Academy. For example, the sixth duty occurrence in Table 12 would be coded as 602.

Specialized Mission Categories. Certain tours available to civil engineer officers have characteristics which make them specialized or distinctive from other positions. The two examples utilized in this study are assignments in the "Black World" and Contingency Duty titles. Duty occurrences in the "Black World" are those where the officer is working in a highly classified context and these duty titles resist categorization as the data is masked to hide location and type of work. Additionally, contingency assignments, in the Desert Storm theater for example, entail duties that are not found among common assignments or permanent duty stations. These two categories fall under the specialized mission heading. For example, the seventh duty title in Table 12 would be coded as 702.

Other Career Paths. Some officers considered in this study either did not start out their career as a civil engineer or are currently no longer a civil engineer. For example, pilots in training that don't graduate are sometimes placed in civil engineering as a new duty AFSC or the officer may have departed permanently from mainstream civil engineering at some point in their career and are currently under a different AFSC. These duty occurrences did show up in the data and were distinguished from career broadening

changes in AFSC because they were not temporary and occurred at the beginning or end of a career. The two categories used in this case were prior civil engineer career and post civil engineer career. For example, the eighth duty title in Table 12 would be coded as 801.

Once the data was coded it was entered into an Excel spreadsheet which displays both the category and timing of each duty occurrence. Figure 7 shows an example of this spreadsheet. The individuals in the population are listed horizontally across the top row. The time in months is shown in the leftmost column. The codes are read down each column providing a chronological profile of an officer's career. For example, officer number one held the 101 position for the twelve months shown in the figure.

	Officer															
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	101	101	101	901	101	303	103	101	104	103	101	103	901	501	201	101
2	101	101	101	901	101	303	103	101	104	103	101	103	901	102	201	101
3	101	101	101	901	101	303	103	101	104	103	101	103	901	102	201	101
4	101	101	101	901	101	303	103	101	104	103	101	103	901	102	201	101
5	101	101	101	901	101	303	103	101	104	103	101	103	901	102	201	101
6	101	101	101	901	101	303	103	101	104	103	101	103	901	102	201	101
7	101	101	101	901	101	303	103	101	104	103	101	103	901	102	201	101
8	101	101	101	901	101	303	103	101	104	103	101	103	901	101	201	101
9	101	101	101	901	101	303	103	101	104	103	101	103	901	101	201	101
10	101	101	101	901	101	303	103	101	104	103	101	103	901	101	201	101
11	101	101	101	901	101	303	103	101	104	103	101	103	901	101	201	101
12	101	101	101	901	101	303	103	101	104	103	101	103	901	303	201	101

Figure 7. Example Formatted Data

MAJCOM Experience

Each duty occurrence is associated with a specific MAJCOM (ACC, AMC, AFMC, etc.) whether it is base level, staff level or otherwise. In this regard, each of these

duty titles were categorized by the MAJCOM accompanying it. The purpose of this categorization theme is to assess the extent of MAJCOM experience for each officer.

The additional categorization theme regarding the MAJCOM experience for each officer offers another perspective on the same raw data. Each duty title occurrence was categorized according to the MAJCOM for that duty occurrence. This provided a historical challenge since the command structure of the Air Force has changed substantially since the early 1980's (Ravenstein, 1985: 10-21 and Ravenstein, 1999: 1-12). For example, in 1991, ACC and AMC replaced MAC, TAC, and SAC; some of the SAC mission went to Space Command. There are some units which do not report to a MAJCOM, but instead report directly to Air Staff or to a joint agency. FOA's and DRU's are examples of these categories. Table 19 shows the comprehensive list of MAJCOMs for the time span considered. Note, there is little correlation between many of the old and new commands, therefore this categorization theme requires the use of the complete list.

Since the data set contains duty titles that span one or more changes in the Air Force command structure, this introduces an anomaly into the data set. For those positions occurring in a MAJCOM during an Air Force restructuring, there may be more than one MAJCOM associated with the position. Therefore, since this could not be addressed in the analysis, caution must be taken when making conclusions on the number of MAJCOMs experienced in a career. The formatted data looks similar to Figure 7.

Table 19. Comprehensive List of MAJCOMs

Operational Commands	Support Commands
Air Combat Command	*3rd Air Division
Air Force Space Command	*Aerospace Defense Command
Air Force Special Operations Command	Air Education and Training Command
Air Mobility Command	*Air Force Communications Command
*Alaskan Air Command	*Air Force Development Test Center
*Military Airlift Command	Air Force Element/Joint
*Pacific Air Command	*Air Force Intelligence Command
Pacific Air Forces	Air Force Materiel Command
*Space Command	*Air Force Systems Command
*Strategic Air Command	*Air Force Logistics Command
*Tactical Air Command	Air National Guard
U.S. Air Forces in Europe	*Air Proving Ground
	*Air Training Command
	*Air Transport Command
	*Air University
	*Continental Air Command
	Direct Reporting Unit
	*Electronic Security Command
	*Far East Air Forces
	Field Operating Agency
	Headquarters, Air Force
	Headquarters, Air Force Reserves
	*North East Air Command
	Office of the Secretary of Defense
	*Special Weapons Command
	*U.S. Air Force Southern Command
* No longer in existence	

Leadership Level

This categorization theme was developed because the level of leadership experience can be an important factor in an officer's career. The data was not entirely conducive to determining the level of leadership in all cases. Therefore, for a duty title to be categorized as a leadership position it had to clearly indicate that the officer was in the top position of an identifiable unit. Any ambiguity in the title resulted in the title not being categorized as a leadership position. The specific leadership levels considered at

base level are flight (or branch) commander and squadron commander or group level commander. At the staff level, the leadership categories applied were branch chief, division chief or director.

There were a few problems encountered in this coding process. First, some actual leadership positions may have been missed if they were ambiguously defined. Second, the staff level leadership positions are not always equivalent between staff organizations. In other words, a branch chief at a numbered air force may not be equivalent to a branch chief at Air Staff. This theme remains valid because a promotion board or commander board would face the same problem in determining the level of leadership in the duty history. The formatted data looks similar to Figure 7.

Overseas Tour

The final categorization theme was to denote each duty occurrence as having taken place overseas or in the Continental US (CONUS). Overseas tours are specifically addressed by the Air Force guidance and each duty title occurrence was denoted as overseas or not. Due to the nature of the duty histories, it was difficult to tell from the command or unit alone whether or not the assignment was overseas. This was handled by considering each duty title occurrence separately and coding them as taking place overseas or not. The formatted data looks similar to Figure 7.

Methods for Analysis

This study primarily uses common descriptive statistics, graphical representations and chi-squared (χ^2) tests to evaluate the empirical data. Specifically, the analysis includes graphs, tests of proportion, and χ^2 tests of categorical data. The tests are

conducted between independent populations as well as against ideal or desired proportions and distributions. The exact statistical method chosen for each question are a function of the type of question asked and type of guidance needed.

Bases for Comparison. There are two main statistical bases for comparison. First, some research questions relate the empirical results to ideal or desired results. Second, some research questions compare the results between two independent populations identified within the data set. These approaches provide the basis for evaluating the career guidance.

Tests of Proportion. This section explains the notation used in the statistical tests for the next chapter. A test of proportion involves statistically comparing two proportions. In some cases, this test is between a population proportion (e.g. P_{cc}) and a proposed proportion (e.g. P_o) and in others, the test is between proportions of two populations (e.g. P_{cc} and $P_{non\text{-}cc}$). The number of individuals in the population is denoted as 'n'. The null hypothesis (H_o) indicates the claim being tested and the alternative hypothesis (H_a) is the conclusion if the null hypothesis is not true. The test statistic (Z) is then compared to the rejection region ($Z_{\alpha=.05}$) which for this research uses a level of significance of 0.05 for all tests. Therefore, if the test results indicate "Do Not Reject," then the null hypothesis is cannot be rejected and conversely, when the results "Reject" the null hypothesis, the alternative hypothesis must be the case. Refer to *Probability and Statistics for Engineering and the Sciences,* fourth edition, Chapters 8 and 9, by Jay Devore for more information on this procedure.

Chi-squared (χ^2) Tests. Some of the statistical tests deals with a χ^2 test of either goodness of fit or homogeneity. In some cases, this test is between a set of categorical

frequencies for a population proportion and a proposed set of categorical frequencies and in others the test is between the frequencies of two populations. The null hypothesis (H_o) will indicate the claim being tested and the alternative hypothesis (H_a) is the conclusion if the null hypothesis is not true. The test statistic (χ^2) is then compared to the rejection region or acceptance criteria ($\chi^2_{\alpha=.05,\, df}$) which for this research uses a level of significance of 0.05 for all tests. The number of degrees of freedom (df) is test specific. Therefore, if the test results indicate "Do Not Reject," then the null hypothesis cannot be rejected and conversely, when the results "Reject" the null hypothesis, the alternative hypothesis must be the case. Refer to *Probability and Statistics for Engineering and the Sciences,* fourth edition, Chapter 14, by Jay Devore for more information on this procedure.

IV. Findings and Analysis

Introduction

This chapter presents the findings from data analysis for the purpose of answering the research question posed in Chapter 3. The next section in this chapter, Population Characteristics, addresses the properties of the population to allow proper segmentation of the data for the remaining analysis. The following section, Overall Model Validity, will test the complete Civil Engineer Career Guidance and pyramid for overall validity. The remaining eight sections will address specific tenets of the guidance in order to provide additional breadth of information for evaluation. Each major topic will address the corresponding research questions referenced in chapter 3 with an analysis and short discussion.

Population Characteristics

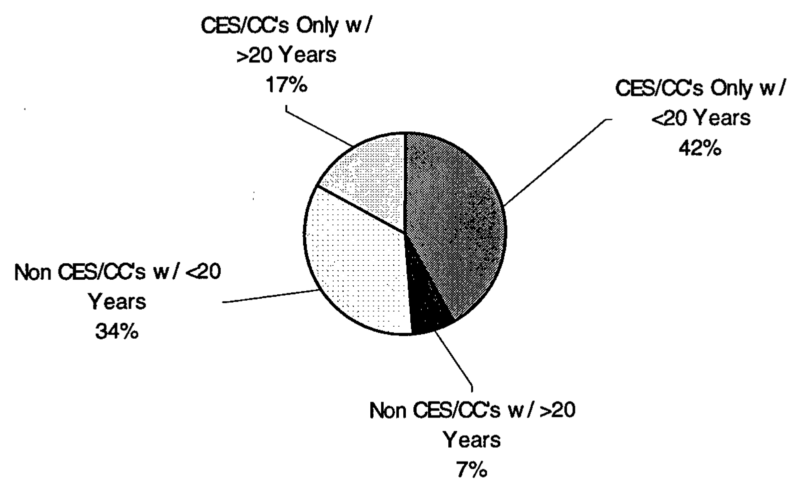
Research Question 1: What are the population characteristics with respect to Civil Engineer Squadron Commander experience and time in service? It is clear from studying the civil engineer career guidance that the primary focus is in grooming civil engineer squadron commanders. In this respect, there are two distinct populations under consideration for this study: those that have been or are currently civil engineer squadron commanders and those who currently do not have this experience. These groups, however, are not entirely dissimilar because the group of non-commanders may at some point in the future become commanders. The data is also divided into the lieutenant colonels with more than 20 years in service and those with careers spanning less than 20

years to further single out the career officers. Table 20 displays these population characteristics and Figure 8 shows the graphical representation of these results.

Table 20. Population Characteristics

	CES Commanders	Non-Commanders	Totals
Less than 20 years	106	86	192
More than 20 years	43	17	60
Totals	149	103	252

Figure 8. Population Characteristics



There are much fewer civil engineer lieutenant colonels over 20 years of service than less than 20 years. The reason is that some of the population has been lost due to separation from the military or promotion to colonel.

Research Question 2: Is there a significant difference between the commanders and non-commanders in career guidance conformity? The commanders and non-commander populations of civil engineer lieutenant colonels with careers over 20 years is too small to accommodate the statistical tests required for this analysis. Therefore, the analysis considers all civil engineer lieutenant colonels that have civil engineer squadron

commander experience at any point in their career and those that do not, regardless of time in service. Consequently, the population of non-commanders may have some of the characteristics of the commanders and this could mask some of the statistical significance between the two populations. Most of the remaining analysis includes statistical tests between these two populations.

Overall Model Validity

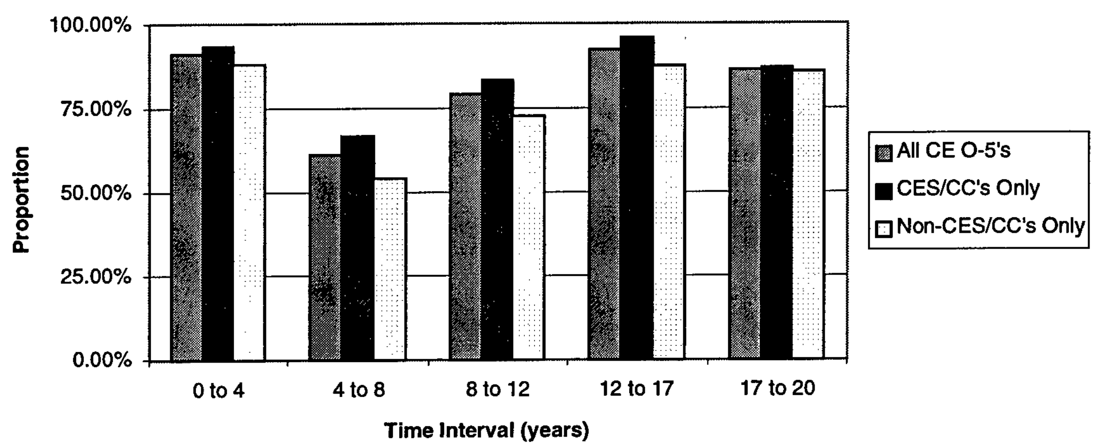
Research Question 3: What proportion of officers conform to the current career guidance? The Air Force provided civil engineer officer guidance and career pyramid is an abbreviated and career encompassing document. It provides guidance and recommendations for the civil engineer officer career from the time the officer enters the Air Force until they have attained an "exceptional career." This research question investigates conformity, where conformity is demonstrated by holding at least one of the positions in the time interval specified by the career pyramid model in Table 2 developed in Chapter 3. For example, for an officer to be in conformance in the first four years of their career, they would have to have worked in either a base level civil engineer flight or in RED HORSE.

Table 2. Career Pyramid Model

Years 0-4	Years >4-8	Years >8-12	Years >12-17	Years >17-20
Base Level Flight RED HORSE	Flight Commander RED HORSE AFCESA AFCEE NAF Staff MAJCOM Staff Career Broadening	Flight Commander RED HORSE AFCESA AFCEE NAF Staff MAJCOM Staff	Ops Commander RED HORSE AFCESA AFCEE NAF Staff MAJCOM Staff Air Staff Joint Tour	CES Commander RED HORSE AFCESA AFCEE NAF Staff MAJCOM Staff Air Staff Joint Tour

There are two perspectives to consider when proceeding with the analysis. First, each block of time is examined separately to identify the proportion of officers, which conform to the guidance for specific blocks of time. The results are shown in Figure 9.

Figure 9. Career Pyramid Compliance by Time Interval

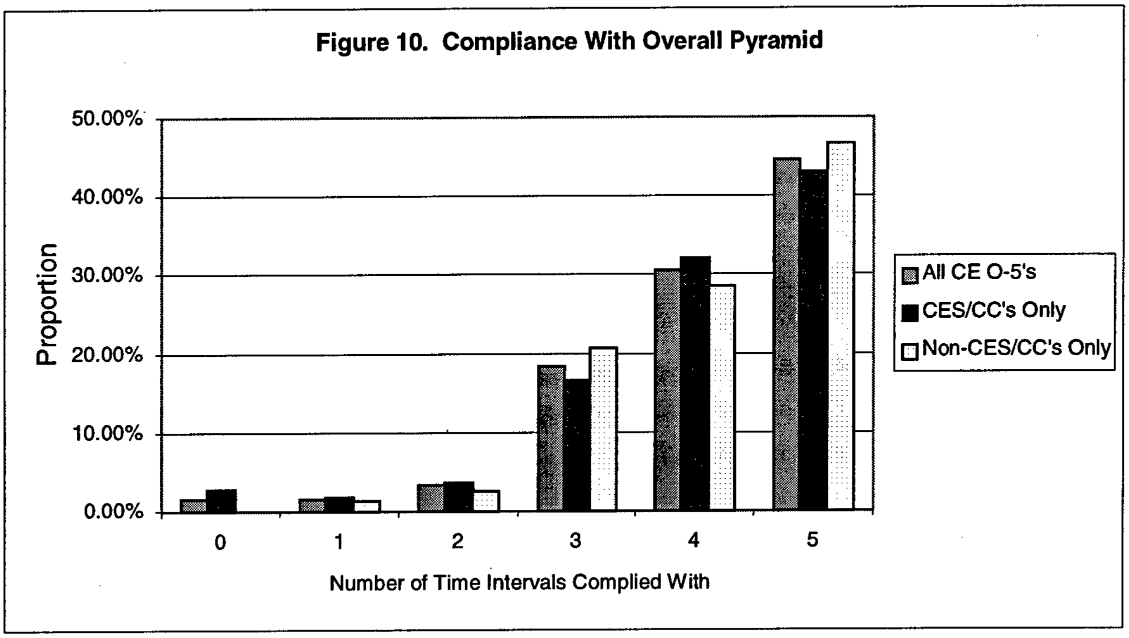


There is strong compliance by all populations in most time intervals. The empirical career profiles conform to the career guidance by 75% or more for most intervals and dip below 70% for the 4 to 8 year point.

The second method used to analyze the career guidance is to consider the career model as a whole. Officers can empirically demonstrate conformity to zero, one, two, three, four or all five of the time intervals presented in Table 2. Since not all officers have careers that extend into the fifth time interval, those officers were excluded from complete model test. Figure 10 shows the results of the complete model test.

Figure 10 strongly suggests the distribution is skewed heavily to the right with between 40 and 50 percent of the officers in every population demonstrating conformity to the entire model. Additionally, interviews with the sponsorship of this thesis indicate a

moderately strong confidence in the career pyramid as a whole. The general shape of the distribution supports this confidence.



The career pyramid emphasizes careers leading to civil engineer squadron commander positions and for this reason the differences in proportions between the commander and non-commander populations were investigated. Table 21 is a test of proportions between the two populations for each time interval in the career model as well as the complete model test.

Table 21. Overall Career Pyramid Test of Proportion between Populations

Testing	P_{CC}	n	P_{NonCC}	n	Ho	Ha	Z	$Z_{\alpha=.05}$	Result
Years 0-4	.93	149	.88	103	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	0.43	1.645	Do Not Reject
Years >4-8	.66	149	.54	103	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	1.57	1.645	Do Not Reject
Years >8-12	.83	149	.73	103	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	1.00	1.645	Do Not Reject
Years >12-17	.96	149	.87	103	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	0.77	1.645	Do Not Reject
Years >17-20	.87	109	.86	77	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	0.08	1.645	Do Not Reject
All Years	.43	109	.47	77	$P_{cc}=P_{non}$	$P_{cc}<P_{non}$	-0.60	1.645	Do Not Reject

The test of proportions between populations indicates that there is not a statistically significant difference in overall model conformance between those that have

worked as a civil engineer squadron commander and those that have not. Therefore, the commanders and non-commanders exhibit the same degree of conformance.

Depth and Breadth

This section addresses three issues relating to the development of depth and breadth. They are flight experience, flight commander experience, and staff experience. The analysis for this section is centered on the appropriate windows of time implied by the career guidance. The flight experience is analyzed for the first eight years of service. The flight commander experience is analyzed for years 4 through 10. Finally, the staff experience is analyzed for years 6 through 12. The time spent in each flight is examined under another major topic, balance, because the proportion of time spent in each flight is not specifically referenced under the depth and breadth topic.

Research Question 4: What proportion of CE officers start their career in a base level CE flight? Not all civil engineer O-5's started their careers in a base level position or even as a civil engineer for that matter. It is important to identify those officers that did not start their career as a base level civil engineer. Figure 11 shows the distribution of each population's first civil engineer duty occurrence.

There were 25 individuals that did not start their career in the civil engineer career field. Of the remaining officers beginning their career as a civil engineer officer, 85% of the civil engineer commanders started their career at base level as compared with 81% for the non-commanders. Table 22 presents the test of proportions between these populations indicating that there is not a statistically significant difference between the two populations.

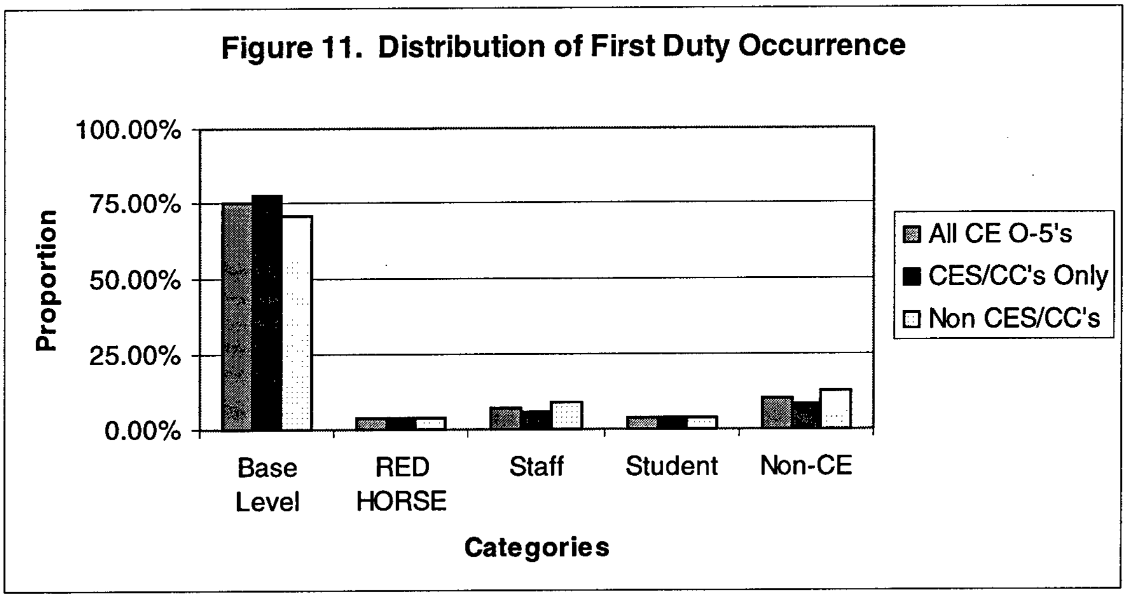
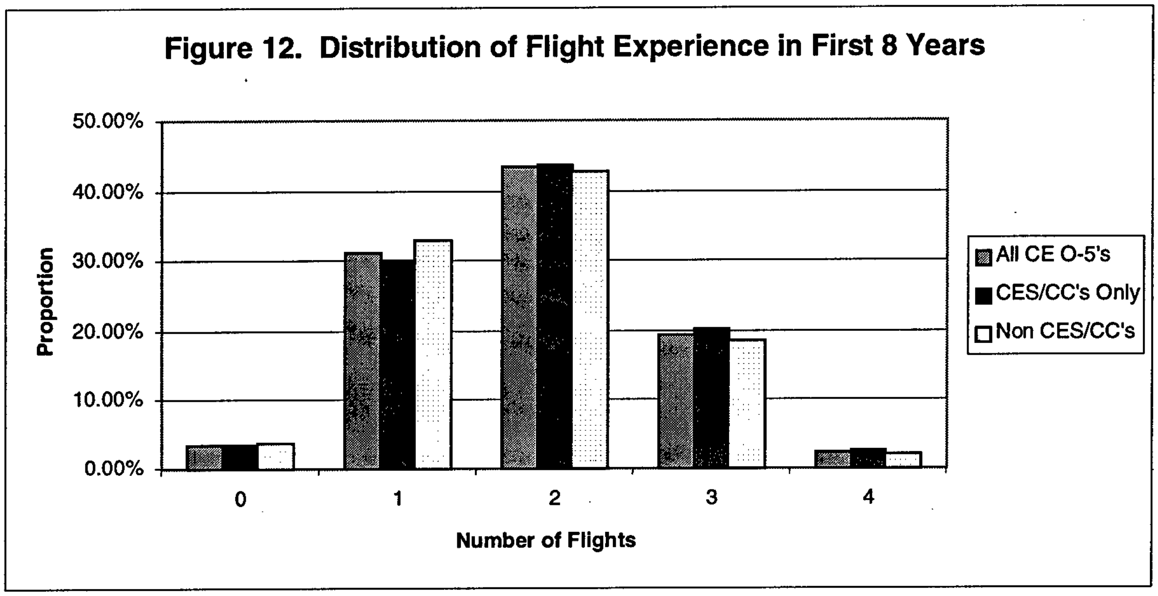


Table 22. First Duty Occurrence Test of Proportion between Populations

Test	P_{cc}	n	P_{non}	n	Ho	Ha	$\lvert Z_{\alpha=.05} \rvert$	Z	Result
1st Duty Occurrence in Base Level	0.85	149	0.81	103	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	1.645	0.32	Do Not Reject

Research Question 5: What number of flights have officers worked in during the first 8 years of service? Technical proficiency within base level civil engineer flights is fundamental to developing depth and breadth within the civil engineer career field. Specifically, the Air Force Guidance recommends gaining experience in the base level flights with officer authorizations. This study was able to identify five generalized categories for base level civil engineer flights: engineering/environmental, operations, resources, readiness and EOD. Theoretically, an officer could work in zero flights or as many as all five flights in the first eight years of their career. The data used for this study found this range to be from zero to four, due primarily to the fact that EOD is a relatively new addition to the civil engineer objective squadron. Figure 12 shows the distribution

of officers with respect to the number of flights in which they have experience during the first eight years of their career.



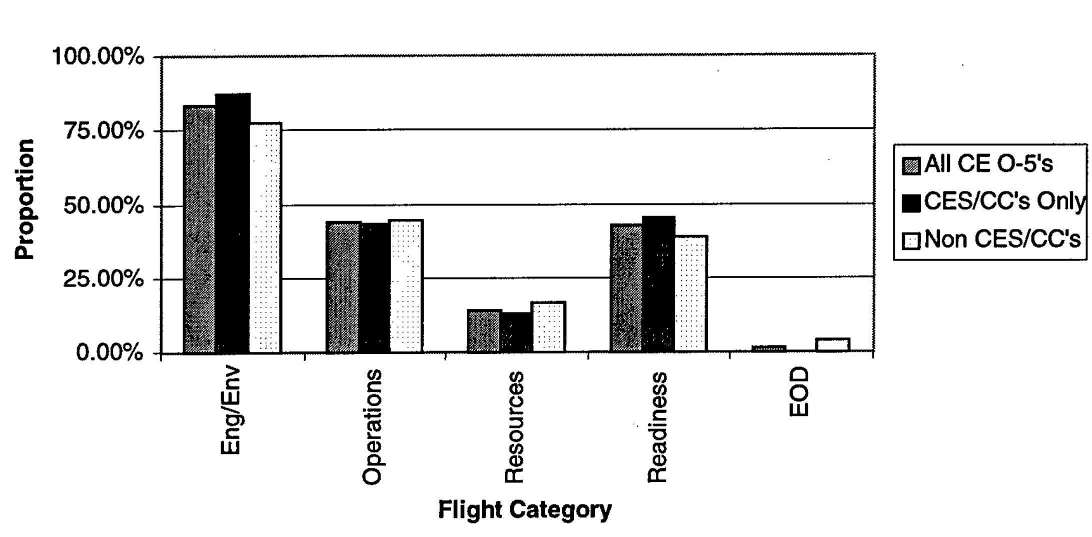
The distribution is somewhat symmetric and centered around 2 flights. The officers with zero flight experience include both civil engineer officers not working at base level as well as those officers assigned to another career field for that time period. Note that more than 60% of the officers have experience in two or more flights in their first eight years of service. A χ^2 test of homogeneity was performed between the commander and non-commander groups. Table 23 shows there is not a statistically significant difference in the number of flights experienced between the commander and non-commander populations.

Table 23. Number of Flights Experienced χ^2 Test between Populations

Test	Ho	Ha	χ^2	$\chi^2_{0.05,4}$	Result
No. Flights Experienced	$P_{1,cc}=P_{1,non}$ …	1 or more P's do not match	0.44	9.488	Do Not Reject

Research Question 6: What is the proportion of officers that have worked in each base level flight category during the first 8 years of service? This question investigates the proportion of officers that have experienced each flight in order to get an idea of where the majority of officer experience has been,. Figure 13 illustrates these proportions.

Figure 13. Flight Experience in Each Flight for First 8 Years



Note there is not mutual exclusivity between the flight categories in Figure 13. Therefore, officers with experience in more than one flight will appear in more than one of the categories in Figure 13.

A larger proportion of officers worked in the engineering/environmental flight category than in any other flight level category. This should relate to the number of officers authorizations for each flight. Table 24 indicates the current core manning for the four flight categories with officer authorizations and the associated proportion of jobs (AFIT, 1996: II.1-IV.4). These core manning numbers have been adapted to correspond to the generalized flight categories used in this research. The EOD flight was excluded

from this particular question because it was not part of a base level civil engineer squadron until recently.

Table 24. Core Officer Manning by Flight

Flight Category	Core Officer Manning	Proportion of Positions
Engineering/Environmental	3+1=4	.5
Operations	2	.25
Resources	1	.125
Readiness	1	.125

These proportions represent the proportion of jobs available at base level for civil engineer officers. Table 25 is a test of proportions for each flight against the proportion of officers in each flight category. The results indicate that the proportion of officers with experience in each flight is as expected for the operations flights. The proportion of officers with experience was less than expected in the engineering/environmental and resources flights and larger than expected in the readiness flight.

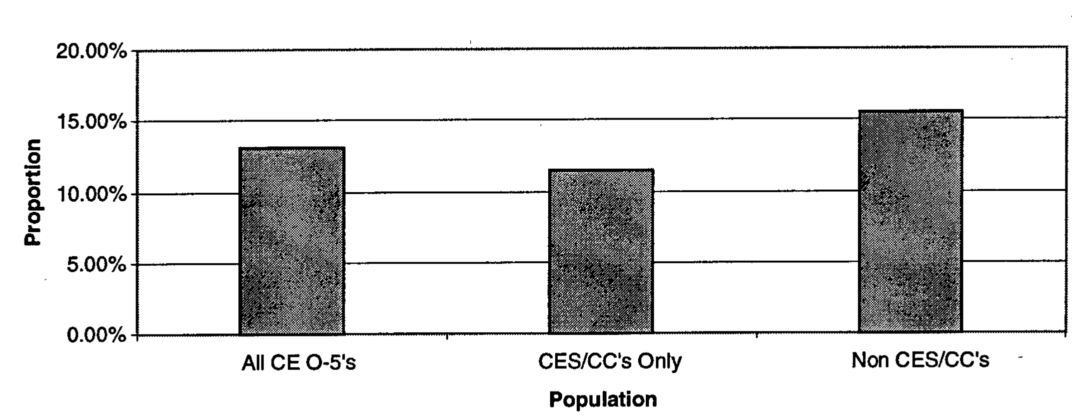
Table 25. Flight Proportions and Core Manning Test of Proportion

	P	n	Po	Ho	Ha	$\lvert Z \rvert$	$Z_{\alpha=.05}$	Result
Eng/Env	0.45	468	0.5	P=Po	P≠Po	2.16	1.645	Reject
Operations	0.24	468	0.25	P=Po	P≠Po	0.50	1.645	Do Not Reject
Resources	0.08	468	0.125	P=Po	P≠Po	2.94	1.645	Reject
Readiness	0.23	468	0.125	P=Po	P≠Po	6.87	1.645	Reject

Research Question 7: What proportion of officers have been base level flight commanders during the 4 to 10 year point? The career pyramid implies a move to become the flight commander of a base level flight builds breadth and depth. The categorization used for this section is somewhat subjective because the duty titles in the population were not categorized as a flight commander unless it could clearly be determined from the duty history. This excludes ambiguous or nebulous flight commander duty titles from the data. For example, many positions not normally

associated with a CE flight or branch had the designator of "chief". Figure 14 depicts the extent of flight commander experience between the 4 and 10 year point for all populations studied.

Figure 14. Proportion with Flight Commander Designator in Years 4-10



The proportion of officers with a flight commander position in the 4 to 10 year point is between 10 and 15 percent for most of the populations. Additionally, there was a noticeable difference between the commanders and non-commanders. A test of proportion is used to determine whether the proportion of non-commanders is statistically larger than the proportion of commanders. Table 26 presents the test conclusions. Unexpectedly, the proportion of non-commanders with base level flight commander experience in the specified time is significantly larger than the proportion of commanders

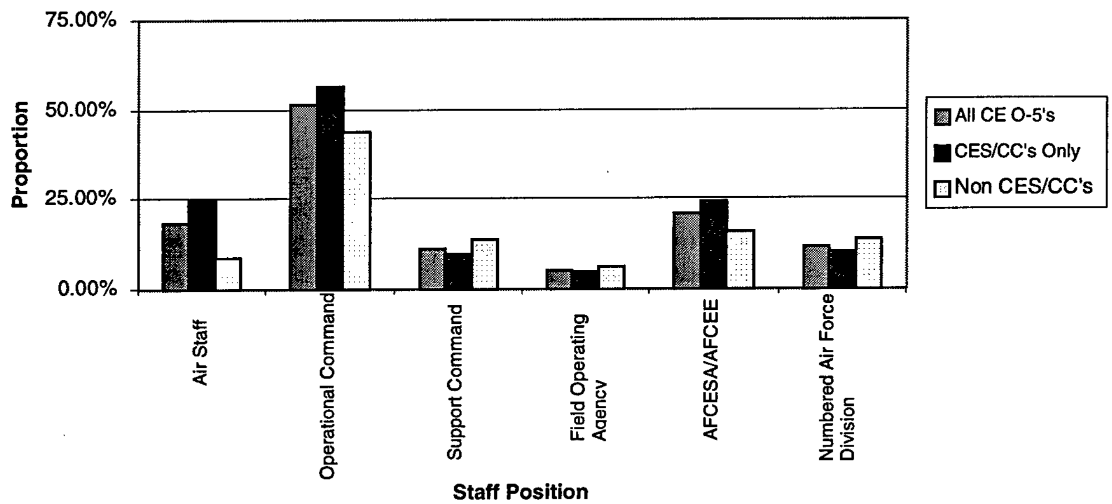
Table 26. Flight Commander Test of Proportion between Populations

Testing	P_{CC}	n	P_{NonCC}	n	Ho	Ha	Z	$-Z_{\alpha=.05}$	Result
$P_{cc}=P_{non}$	0.11	149	0.16	103	$P_{cc}=P_{non}$	$P_{cc}<P_{non}$	-2.42	-1.645	Reject

Research Question 8: What proportion of officers have worked in a FOA (CE type or other) or a headquarters staff during the 6 to 12 year point? The guidance indicates that additional depth and breadth may be gained by working in a FOA or headquarters

during the 6 to 12 year point. Figure 15 illustrates the distribution of officers among the noted staff positions. The different staff categories are discussed in depth in Chapter 3.

Figure 15. Distribution of Staff Jobs in Years 6-12



For each staff category shown, the proportion of each complete population with that particular job is denoted. The largest proportion of officers worked in the operational command staff category for the entire data set.

Additionally, 15% of the commanders and 23% of the non-commanders did not hold a staff position at all during the period considered. Table 27 tests the proportions of conformity between the two populations. The proportion of commanders with a staff position in years 6 to12 is not statistically larger than the proportion of non-commanders that held a staff position in the years 6 to12.

Table 27. Staff Positions in Years 6 to 12 Test of Proportion of between Populations

Testing	P_{CC}	n	P_{NonCC}	n	Ho	Ha	Z	$Z_{\alpha=.05}$	Result
Staff in years 6-12	0.85	149	0.77	103	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	0.76	1.645	Do Not Reject

Progression

Progression within the civil engineer career field is demonstrated by moves such as from a flight level position to the commander of that flight. Progression can take place within an organization or throughout a career. In this regard, progression indicates the officer's potential to take on increased responsibility.

Research Question 9: What proportion of officers hold a chief of operations position before progressing to a civil engineer squadron commander position? The progression investigated for this research is the increased responsibility of moving from operations flight commander to civil engineer squadron commander. This question proposes that the operations flight chief position is a milestone in the career path to civil engineer squadron commander. Table 28 shows the two-way contingency table depicting the officers with civil engineer squadron commander and operations flight commander experience. Figure 16 shows the graphical depiction of Table 28.

Table 28. Operations Flight and CE Squadron Commander Characteristics

	CES/CC	Non-CES/CC	Totals
Ops/CC	90	56	146
No Ops/CC	59	47	106
Totals	149	103	252

The results in Table 29 indicate that there is a statistically significant difference between the proportion of officers with operations flight chief and civil engineer squadron commander experience and those that only have civil engineer squadron commander experience.

Figure 16. Operations Flight and CE Squadron Commander Characteristics

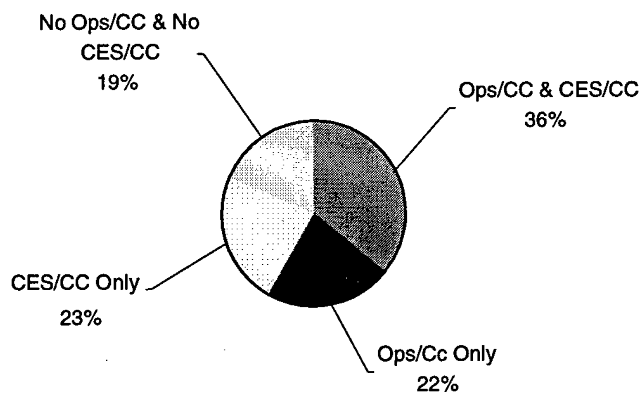


Table 29. Operations Flight Chief Test of Proportions between Populations

Testing	$P_{ops\&cc}$	n	$P_{cc\ only}$	n	Ho	Ha	Z	$Z_{\alpha=.05}$	Result
Operations Flight Chief experience	0.36	146	0.23	106	P_o=P	P_o>P	4.299	1.645	Reject

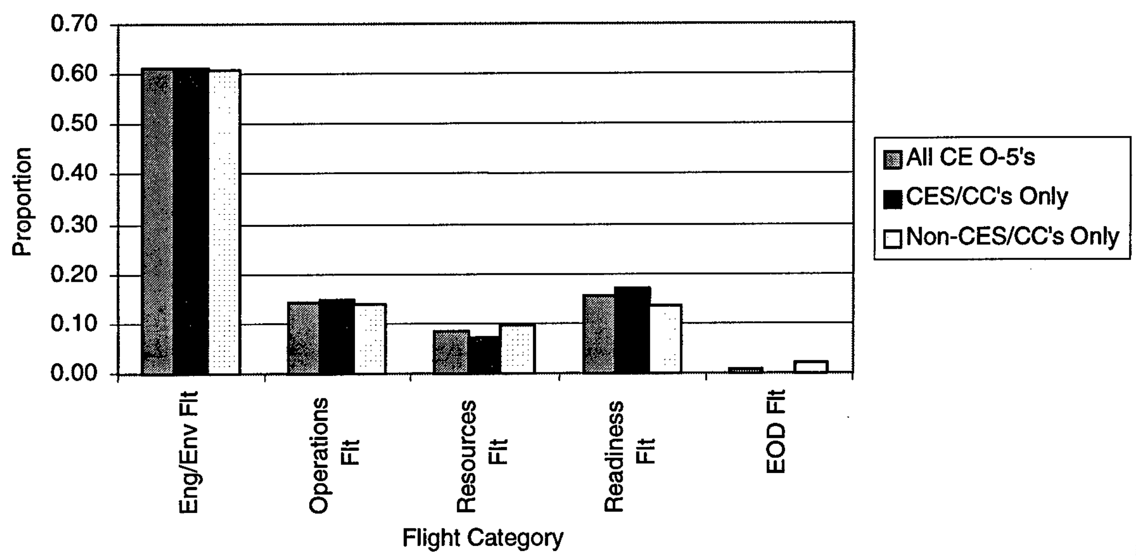
Balance

The balance under consideration for this research is the balance of time between job types. Specifically, the time in each flight during the first eight years should be proportional to the available officer positions in those flights as indicated in Table 24. Additionally, there may be some proportional balance of time between the base level and staff level positions a civil engineer officer holds in their career.

Research Question 10: How much time have officers spent in each of the base level flights? Is the time spent in each flight category proportional to the core officer authorizations in those flights? As indicated in Table 24, there are not equal

opportunities for officers to work in all of the six base level civil engineer flights. Therefore, the time spent in these flights should correspond to the available positions rather than an equal distribution of time. Figure 17 relates the proportion of overall base level time spent in each of the five flight categories used for this study.

Figure 17. Proportion of Base Level Time Spent in Each Flight



Note that for all populations, over 60% of the base level flight time was spent in the engineering/environmental flight category. Table 30 presents the test of proportion against the proposed proportions in Table 24. In this case, only the time spent in the readiness flight corresponds to the core manning in the base level flights.

Table 30. Time in Base Level Flights and Core Manning Test of Proportions

Flight Category	P	n	Po	Ho	Ha	|Z|	$Z_{\alpha/2=.05}$	Result
Eng/Env	0.61	252	.5	P=Po	P≠Po	3.49	1.645	Reject
Operations	0.14	252	.25	P=Po	P≠Po	4.03	1.645	Reject
Resources	0.08	252	.125	P=Po	P≠Po	2.16	1.645	Reject
Readiness	0.15	252	.125	P=Po	P≠Po	1.20	1.645	Do Not Reject

A χ^2 test of homogeneity was also conducted between three of the flight categories of the commander and non-commander populations. The results are summarized in Table 31. The time spent in the operations flight and the readiness flight are the same between the commander and non-commander populations. However, the distribution of time in the engineering/environmental flight is not statistically homogeneous across these populations.

Table 31. Time in Base Level Flights χ^2 Test between Populations

Flight Category	χ^2	α	ν	$\chi^2_{.05,5}$	**Result**
Eng/Env	25.65	0.05	8	15.507	Reject
Operations	8.13	0.05	5	11.07	Do Not Reject
Readiness	1.99	0.05	5	11.07	Do Not Reject

Research Question 11: How much time have officers spent in each type of job? Is the time spent in base level and staff level positions equally balanced? There are a wide variety of jobs a civil engineer officer can hold. This question addresses the major areas officers can work in over their entire career. The two main breakouts are base level and staff level. The other broad categories are RED HORSE, career broadening, student, instructor, specialized mission, and other career path. Figure 18 shows the proportion of time spent in each of these broad job types.

The preponderance of time is spent at base level or staff level and the subordinate categories all consume less than 10% of the officer's career. Table 32 is a test of the balance of proportion between these two job types. The results indicate that there is a balance of time between the base level jobs and staff level jobs. Officers in the data set have spent equal proportions of their career in base level positions and staff level positions.

Figure 18 Proportion of Time in Broad Categories

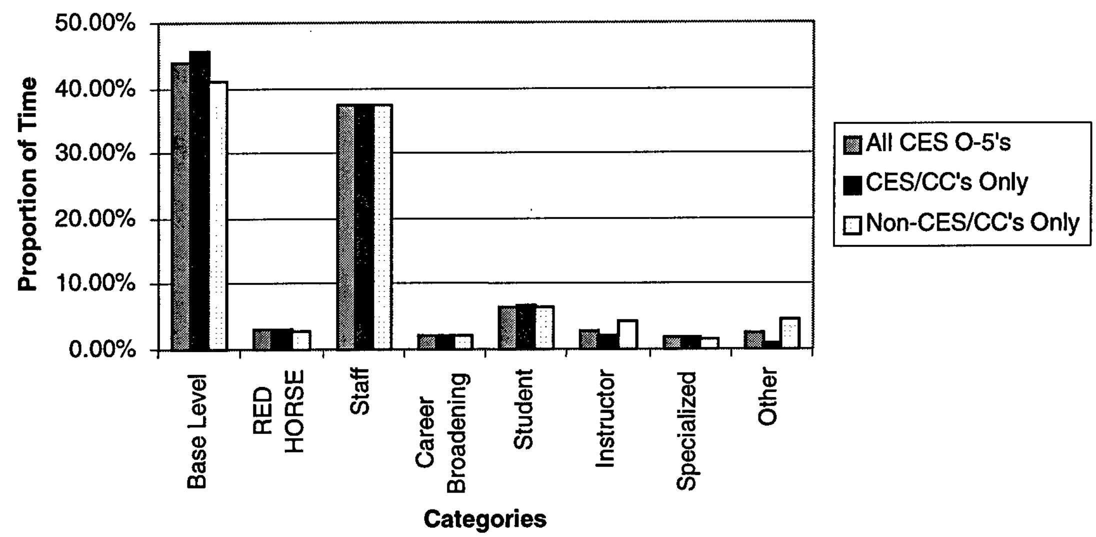


Table 32. Base Level and Staff Level Test of Proportion

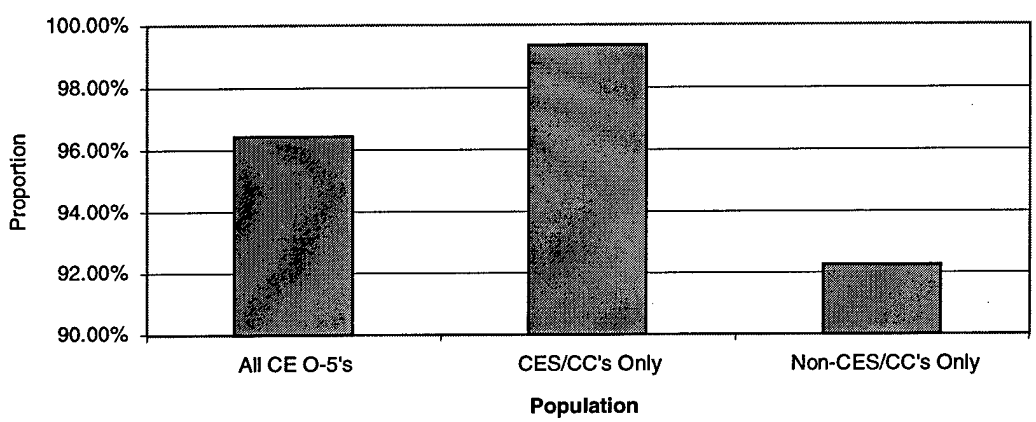
Test	Ho	Ha	df	χ^2	$\chi^2_{.05,21}$	Result
Homogeneity Between Base and Staff Level	$P_{base,1}=P_{staff,1}$	At least 1 $P_{bse,1}\neq P_{staff,1}$	21	24.83	32.67	Do Not Reject

Overseas Tour

There are many opportunities for civil engineer officers to spend a tour overseas. The guidance specifically mentions overseas tour as good place to "hone skills." Therefore, the following two research questions examine the proportion of officers that have completed an overseas tour and the time they have spent there. It was not possible to accurately evaluate the number of overseas assignments for each officer due to the nature of the data set.

Research Question 12: What proportion of officers have had at least one overseas tour? The proportion of officers with overseas tours is presented in Figure 19. These proportions actually represent those officers in each population with both overseas and CONUS tours since all officers have at least one CONUS tour.

Figure 19. Proportion With Time Overseas



All populations exhibit a proportion of overseas tours over 90 percent. Note the scale on the y-axis of Figure 19 is from 90% to 100%. Table 33 presents the test of proportion between populations. The results show there is not a statistically significant difference in the proportions of commanders and non-commanders with an overseas tour.

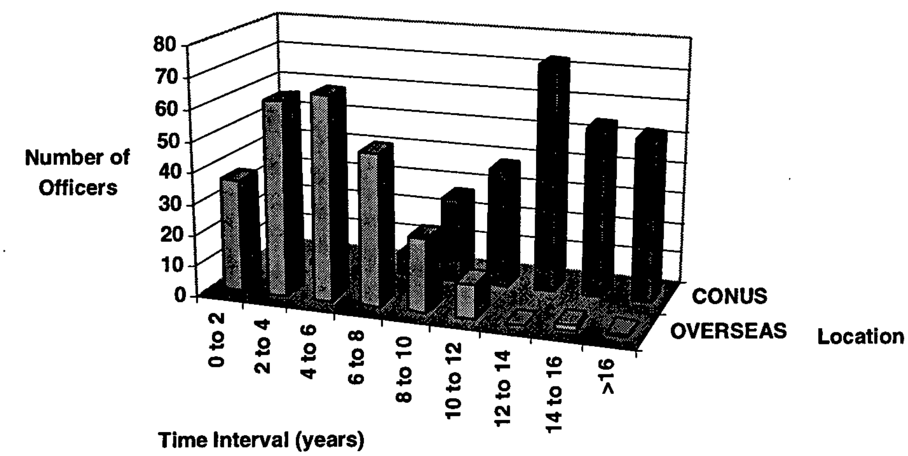
Table 33. Overseas Tours Test of Proportion of between Populations

Testing	P_{cc}	n	P_{non}	n	Ho	Ha	Z	$Z_{\alpha=.05}$	Result
Proportion of Overseas	0.99	149	0.92	103	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	0.58	1.645	Do Not Reject

Research Question 13: How much time have officers spent overseas? There is no guidance on the specific amount of time civil engineer officers should spend overseas. Investigating this question provides a graphical analysis of the time distribution between overseas and CONUS tours. Figure 20 illustrates the time spent overseas and CONUS.

Note the commander and non-commander populations are not broken out for ease of understanding the figure.

Figure 20. Time CONUS vs Overseas



Most officers spend more time CONUS than overseas. Roughly one third of the time was spent overseas and two thirds was spent CONUS. This is not unexpected since the civil engineer officer positions are more plentiful in the CONUS. Figure 21 displays the proportion within each time interval for the commander and non-commander populations

Figure 21. Time Spent Overseas by Population

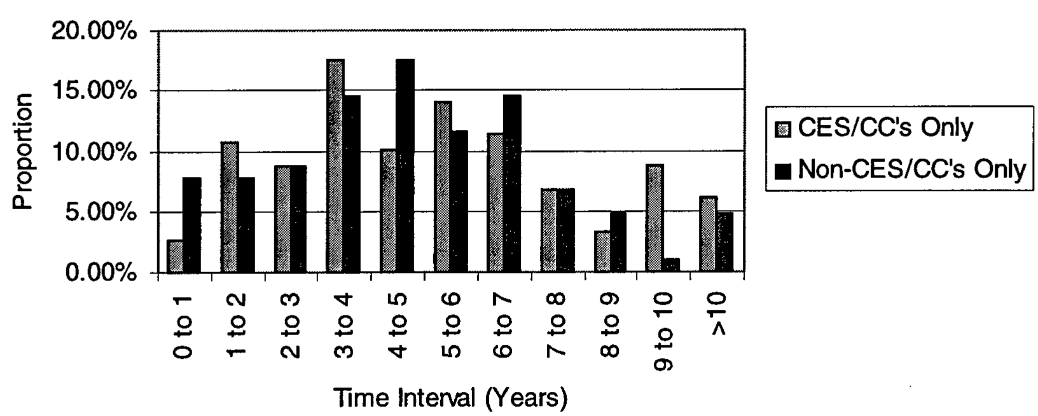


Table 34 summarizes the χ^2 test of homogeneity of time spent overseas between the populations. There is not a statistically significant difference in the total overseas time between commanders and non-commanders.

Table 34. Time Overseas χ^2 Test between Populations

Test	Ho	Ha	df	χ^2	$\chi^2_{.05,10}$	Results
Homogeneity between CC's and Non-CC's	$P_{cc,1}=P_{non,1}$	At least 1 $P_{cc,1}\neq P_{non,1}$	10	14.58	18.307	Do Not Reject

MAJCOM Experience

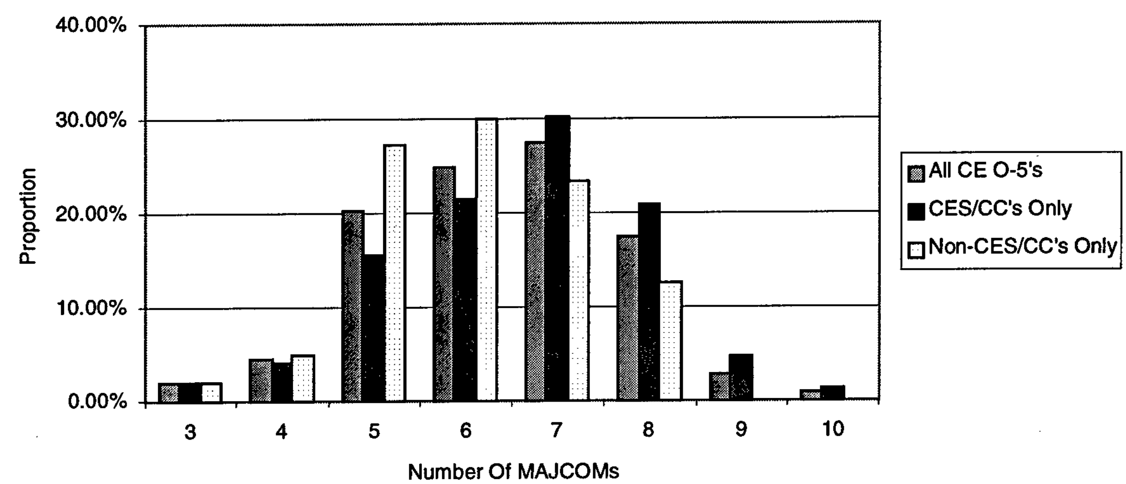
Each of the duty occurrences in the data set is associated with a specific MAJCOM. The three research questions answered in this section relate to the number of MAJCOMs worked in, the proportion of time in each MAJCOM, and the distribution of officers that have worked in each type of MAJCOM.

Research Question 14: In how many different MAJCOMs have officers worked in? The Air Force guidance indicates that experience in several different MAJCOMs will provide a broader view of the Air Force. This question investigates the actual number of MAJCOMs in which each population has worked. Theoretically, an officer could work in as few as one or could work in a different MAJCOM with each successive assignment. The true range, as determined by this analysis, is from three to ten MAJCOMs. Figure 22 shows the distribution of officers with respect to the number of MAJCOMs they have experienced.

The distribution is roughly symmetric and centered around six to seven MAJCOMS. Note that due to the changes in Air Force structure in the past, the actual

number of MAJCOMs would be less than indicated since some positions may be associated with more than one MAJCOM.

Figure 22. Number of MAJCOMs Experienced



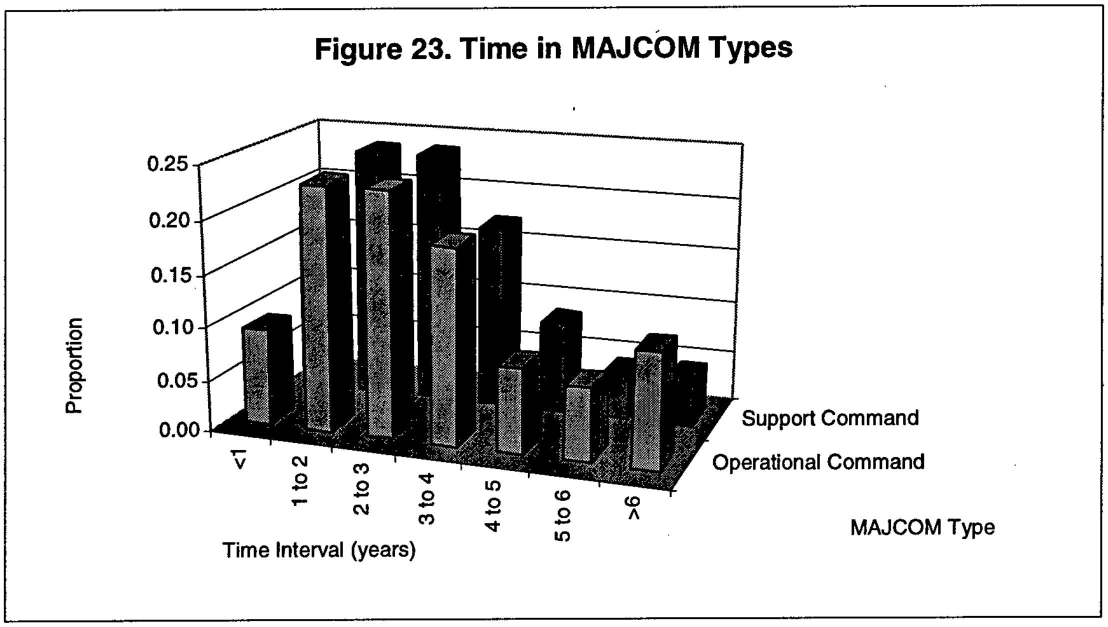
A χ^2 test of homogeneity between populations is presented in Table 35. There is not a statistically significant difference in the number of MAJCOM's worked in between the commanders and non-commanders.

Table 35. Number of MAJCOMs Experienced χ^2 Test between Populations

Test	Ho	Ha	df	χ^2	$\chi^2_{.05,7}$	Results
No. of MAJCOMs between populations	$P_{cc,1}=P_{non,1}$	At least 1 $P_{cc,1}\neq P_{non,1}$	7	13.348	14.067	Do Not Reject

Research Question 15: What proportion of time have officers spent in each MAJCOM? There have been so many MAJCOMs in the Air Force over the past 20 years alone that it is nearly impossible to present the proportion of officers within each of them. Instead, the MAJCOMs will be classified at either operational or support commands as discussed in Chapter 3. Each duty occurrence then belongs to one of those two types of

commands. Figure 23 presents the proportion of time within each of these command types. Note the commander and non-commander populations are not broken out for ease of understanding the figure.



The distributions of time proportions are both skewed to the left with most officers remaining in a particular MAJCOM from one to three years. A χ^2 test of homogeneity was performed. The results are shown in Table 36.

Table 36. Time in MAJCOM Types χ^2 Test

Test	Ho	Ha	df	χ^2	$\chi^2_{.05,6}$	Result
Homogeneity between operational and support	$P_{cc}=P_{non}$	At least 1 $P_{cc,1} \neq P_{non,1}$	6	11.93	12.59	Do Not Reject

There is not a statistically significant difference between the time officers spend in operational commands and the time officers spend in support commands. Additionally, Table 37 investigates the homogeneity between the populations. There is not a statistically significant difference between the commanders and non-commanders in

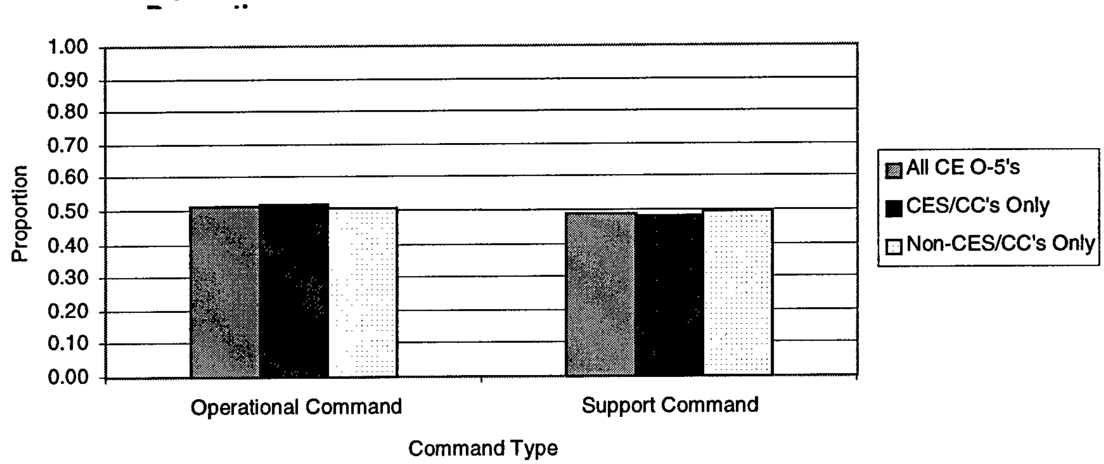
the time spent in operational commands. However, there is a statistical difference in the amount of time spent in support commands between commanders and non-commanders.

Table 37. MAJCOM Types χ^2 Test between Populations

Test	Ho	Ha	df	χ^2	$\chi^2_{.05,7}$	Result
Operational	$P_{cc}=P_{non}$	At least 1 $P_{cc,1} \neq P_{non,1}$	7	1.46	14.067	Do Not Reject
Support	$P_{cc}=P_{non}$	At least 1 $P_{cc,1} \neq P_{non,1}$	7	32.7	14.067	Reject

Research Question 16: What is the proportion of officers that have worked within each MAJCOM? There have been so many MAJCOMs in the Air Force in the past 20 years, considering each of them would not provide a clear analysis. Therefore, only the general type of MAJCOMs are evaluated. Each MAJCOM can be classified as either an operational MAJCOM or a support MAJCOM. In this respect, Figure 24 presents the proportion of officers working in each type of MAJCOM. The proportion of officers from each population working in each type of MAJCOM is roughly 50%.

Figure 24. Proportion of Duty Occurrences by MAJCOM

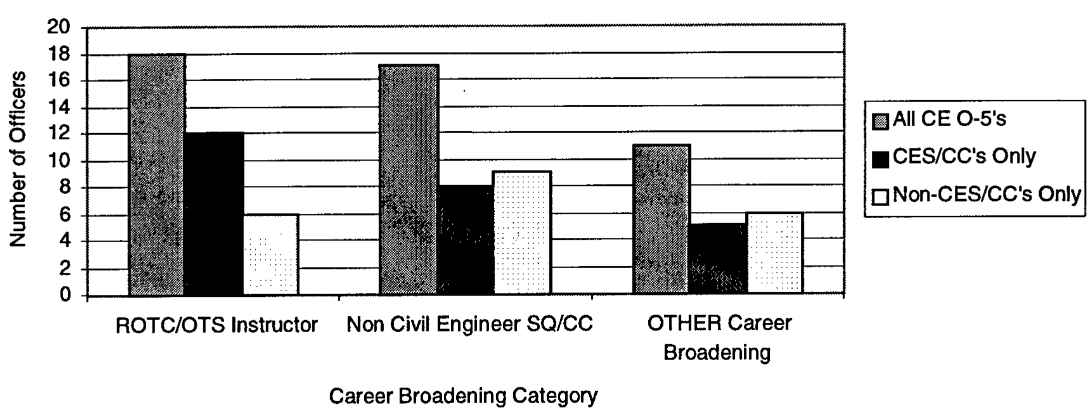


Career Broadening

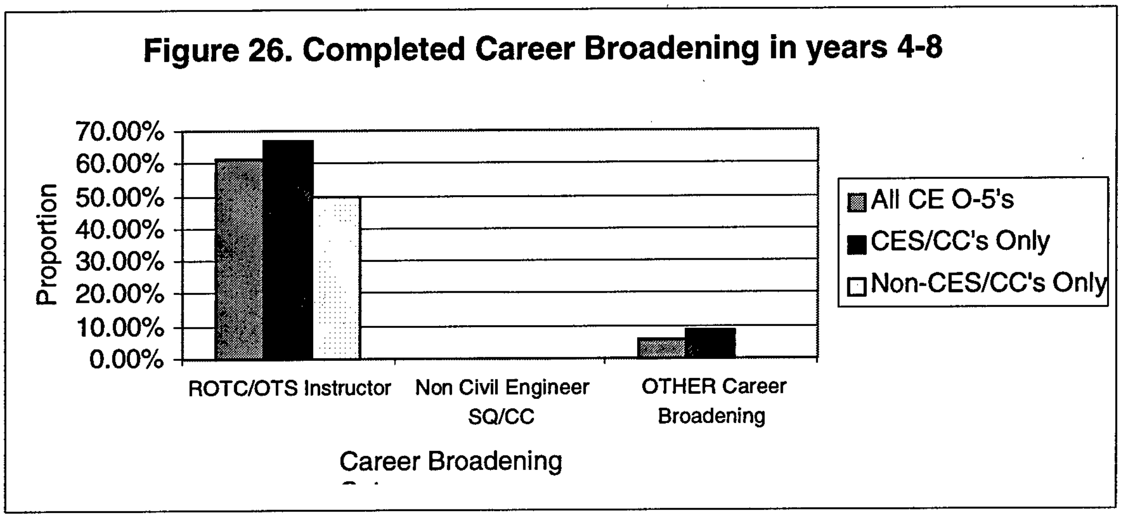
Some officers are afforded the opportunity to work outside the civil engineer career field temporarily. The Air Force guidance recommends this be accomplished as a junior captain. The analysis for this section will investigate the timing and type of career broadening for each of the populations. The research questions are combined for this tenet because they are interrelated.

Research Questions 17, 18 and 19: What proportion of officers have completed a career broadening tour? Of those that have, what proportion did so during the 4 to 8 year point? What is the proportion of officers within each career broadening type? The positions available for civil engineer officers to complete a career broadening tour are somewhat limited. This analysis investigates some common career broadening tours that are available to most officers throughout a career. Figure 25 shows the number of officers in each category that have had a these type of career broadening tour. The career broadening positions falling under the "other" category include positions such as SOS

Figure 25. Career Broadening



The Air Force guidance recommends career broadening tours be completed as soon in a career as possible so as not to miss other key career development opportunities. Figure 26 shows the proportion of those officers with career broadening tours that have completed them in the specified time period.



Most of the ROTC and OTS tours were completed in the time specified by the Air Force Guidance. Note no officers in the data set completed a non-civil engineer squadron commander position in the time specified because this opportunity is not available to junior captains. A test of proportion between the populations is shown in Table 38.

Table 38. Career Broadening Test of Proportion between Populations

Test	P_{cc}	n	P_{non}	n	Ho	Ha	|Z|	$Z_{.05}$	Result
All	0.168	149	0.204	103	$P_{cc}=P_{non}$	$P_{cc}<P_{non}$	1.518	1.645	Do Not Reject
Years 4-8	0.529	25	0.25	21	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	2.035	1.645	Reject

There is not a statistically significant difference between the commanders and non-commanders in the overall proportion with career broadening. However, the commanders demonstrated a significantly larger proportion that completed the career

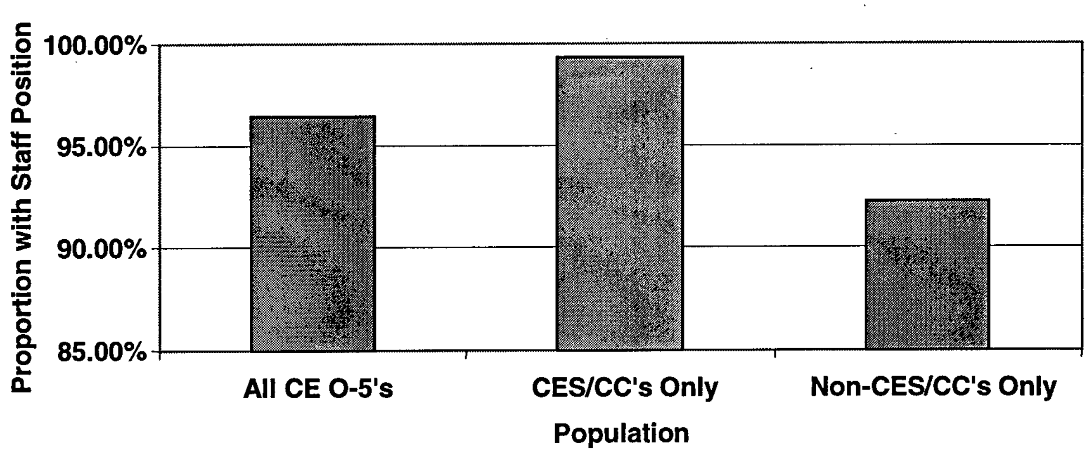
broadening in the time recommended by the Air Force guidance than the non-commanders.

Staff Positions

Staff billets are plentiful for officers at all levels. This portion of the analysis will examine the type of staff billets taken and the time spent in those positions. Specifically, the questions answered pertain to the proportion of officers that have had a staff tour in their entire career, what the distribution of those staff positions is and how long the officers have remained at those positions.

Research Question 20: What proportion of officers have had a staff tour? Nearly every officer should have had the opportunity at one time or another to fill a staff level position. Figure 27 shows the proportions of each population that held a staff level position in their career.

Figure 27. Proportion with Staff Positions for Entire Career



The proportion of officers with a staff tour is over 90 percent for all populations. Note the scale in the y-axis is from 85% to 100%. Table 39 shows the test of proportions

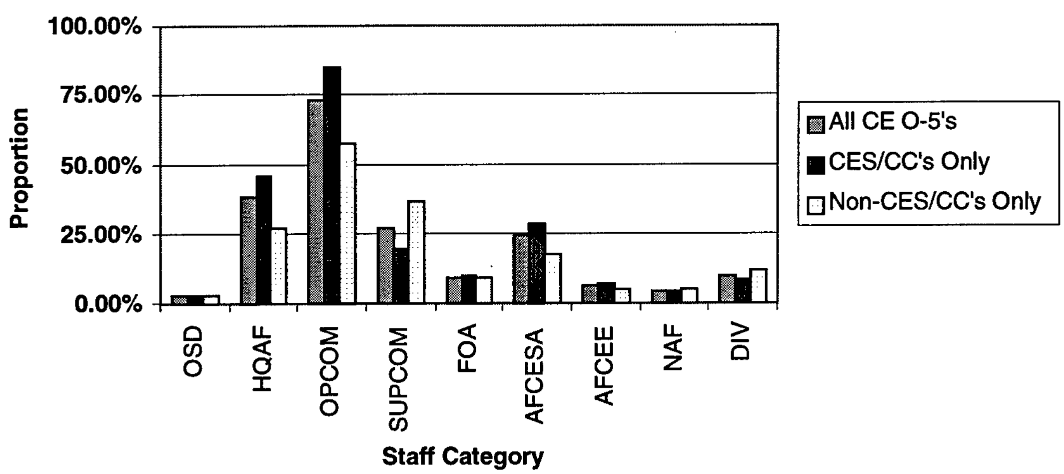
between the populations for this question. There is not a statistically significant difference between the commanders and non-commanders in the proportion having held a staff position.

Table 39. Staff Positions for Entire Career Test of Proportions between Populations

Test	P_{cc}	n	P_{non}	n	Ho	Ha	Z	$Z_{.05}$	Result
Staff Position Between Populations	.99	149	.92	103	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	0.579	1.645	Do Not Reject

Research Question 21: What is the proportion of officers within each staff category? This differs from research question 8 in that it considers the entire career of each officer rather than a specified time period. There are many different staff positions a civil engineer officer can hold. Figure 28 shows the proportion of officers that have worked in each of the most traditional staff positions.

Figure 28. Distribution of Staff Positions for Entire Career

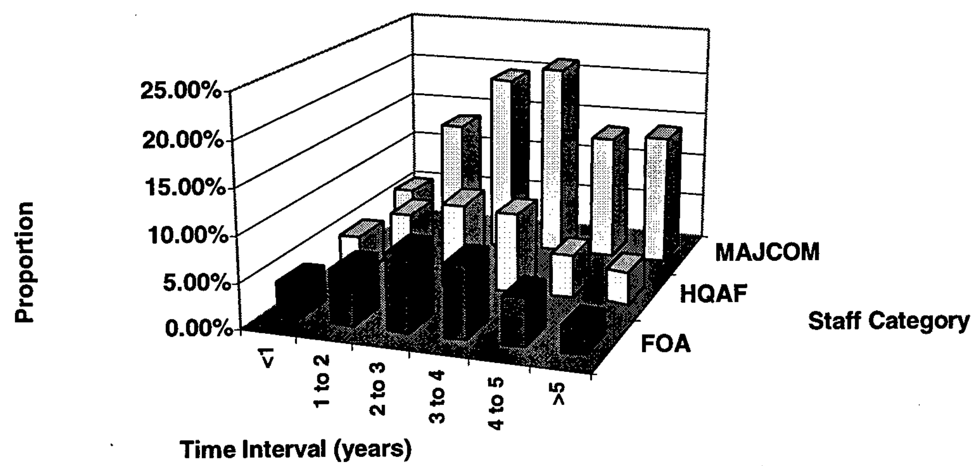


The most common staff positions for an officer to have are MAJCOM staff (operational more so than support), Air Staff, or AFCESA. AFCEE has become a popular staff position for civil engineers, but since it is a relatively new organization, it

did not demonstrate proportions equivalent to AFCESA. The large difference in the operational versus support command staff proportions is possibly due to the authorized positions within those types of commands.

Research Question 22: How long have officers remained in staff positions? There are many staff positions and they all have unique characteristics such as tour length. Therefore, this question examines the cumulative time spent three common staff positions. They are MAJCOM staff, Air Staff, and FOA. Figure 29 shows the selected time intervals for all of the populations in these staff positions.

Figure 29. Cumulative Time in Staff Positions



Most of the distributions for these staff positions are symmetrical and centered around two to four years for each position held. Figure 30 shows the time spent at staff level positions for the commander and non-commander positions.

Table 40 shows the χ^2 test of homogeneity between populations for each of the top three staff positions similar to research question 13. There is not a statistically

significant difference in the time spent among the top three staff positions between the commander and non-commander populations.

Table 40. Time in Staff Positions for Entire Career χ^2 Test between Populations

Test	Ho	Ha	df	χ^2	$\chi^2_{.05,7}$	Result
FOA	$P_{cc}=P_{non}$	At least 1 $P_{cc,1} \neq P_{non,1}$	6	11.11	12.592	Do Not Reject
MAJCOM	$P_{cc}=P_{non}$	At least 1 $P_{cc,1} \neq P_{non,1}$	6	7.63	12.592	Do Not Reject
Air Staff	$P_{cc}=P_{non}$	At least 1 $P_{cc,1} \neq P_{non,1}$	6	8.38	12.592	Do Not Reject

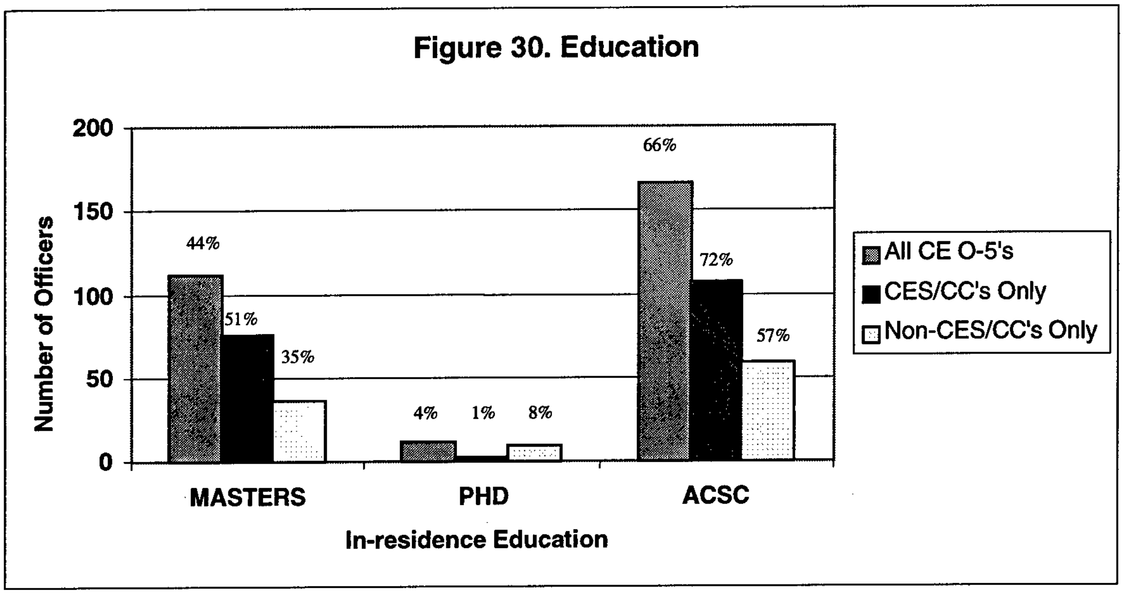
Education

Education is the final research item studied. There are two kinds of education considered here: advanced academic degree programs and professional military education. This question is intended to investigate the extent of advanced academic degrees by all officers, however the data collected limited the study to only those in-residence programs that show up in the duty history. The critical items discussed are in-residence masters degrees, doctor of philosophy degrees and Air Command and Staff College.

Research Questions 23 and 24: What proportion of officers have completed a masters degree, PhD or in-residence ACSC? The opportunities for officers to attend in-residence academic and PME education are limited. This question examines the proportion of each population that has obtained a Masters, PhD or ACSC in-residence. Figure 30 shows the number in each population completing this education in-residence.

Nearly half of the officers studied have completed an in-residence masters degree. Since it is assumed that all lieutenant colonels have obtained a masters degree, the remaining officers must have completed one through off-duty education. A much smaller

proportion has completed an in-residence PhD. This reflects the limited opportunities for civil engineer officers to pursue this level of in-residence education.



Although the numbers attending in-residence PME fluctuate by year group, it is significant to note that a large proportion of the officers in this data set have completed ACSC in-residence. Table 41 shows the test of proportions between populations in-residence education.

Table 41. Education Test of Proportion between Populations

Test	P_{cc}	n	P_{non}	n	Ho	Ha	$\lvert Z \rvert$	$Z_{.05}$	Result
Masters	0.51	149	0.35	103	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	2.97	1.645	Reject
PhD	0.01	149	0.09	103	$P_{cc}=P_{non}$	$P_{cc}<P_{non}$	16.85	1.645	Reject
ACSC	0.72	149	0.57	103	$P_{cc}=P_{non}$	$P_{cc}>P_{non}$	1.77	1.645	Reject

Therefore, the commanders have a statistically higher proportion of in-residence masters degrees and in-residence ACSC attendees than the non-commanders. Additionally, the non-commanders have a statistically larger proportion of PhD's than the commanders.

Final Comments on the Analysis

The analysis presented in this chapter was an assessment of the proposed research questions using the duty history data from all civil engineer lieutenant colonels as of 15 September, 1999. First the population characteristics were evaluated to arrive at an appropriate set of populations for statistical comparison in the remaining questions. Then the overall Air Force career guidance and career path pyramid were tested. The analysis progressed through eight sections, which successively addressed the remaining research questions. The results in this chapter are objective and quantitative in nature. To complete this study, the results must be tied back to the Air Force civil engineer career guidance and related to the theory developed in Chapter 2 of this thesis. Therefore, the next chapter integrates the analysis of the complete Air Force civil engineer career guidance with expectancy and goal theory to arrive at recommendations, which support or improve the Air Force career guidance.

V. Conclusions and Recommendations

Introduction

This chapter summarizes and interprets the results of the analysis completed in Chapter 4. The results are presented by major topic heading: Career Guidance Focus, Overall Test of the Career Pyramid, Breadth and Depth, Progression, Balance, Overseas Tour, MAJCOM Experience, Career Broadening, Staff Positions, and Education. Each section employs the data analysis in response to each of the research questions. The purpose is to achieve an evaluation of the strengths and weaknesses of the career guidance for both the entire data set and between the commander and non-commander populations as appropriate. Specific recommendations on the career guidance are made based on the conclusions of this analysis and the theoretical framework developed in the literature review. Finally, some suggestions are made for further research.

Career Guidance Focus

Conclusions. The results found that a substantial proportion of the officers in the data set did have civil engineer squadron commander experience. More than twice as many officers with 20 or more years in service had commander experience than did not. Over half of all of the officers in the data set did have civil engineer squadron commander experience. This indicates that the guidance is justified in focusing attention on civil engineer squadron commanders as a high valence outcome. The large proportion of civil engineer squadron commanders suggests a significant probability of achieving this outcome therefore indicating a large valence. This study intended to evaluate the characteristics of career officers with civil engineer squadron commander experience and

this was assumed to be the high valence outcome. However, since the number of lieutenant colonels over 20 years was small, the remaining analysis compared the civil engineer squadron commanders to the non-commanders for all career lengths.

Overall Test of the Career Pyramid

Conclusions. The overall test of the career pyramid and career guidance validates the Air Force Civil Engineer career guidance as the comprehensive model shown in Table 2. Figure 9 of the analysis indicates a strong tendency for this group of lieutenant colonels to conform to the career pyramid. In the year-by-year analysis, the conformity was nearly 75% for most years dipping to around 60% in the four to eight-year time interval. Additionally, the composite analysis in Figure 10 showed a strong inclination toward overall career conformity for both the civil engineer squadron commanders and non-commanders. The distribution indicating the total number of time blocks conformed to in a career was skewed heavily to the right with the over 40% demonstrating a complete conformity to the career pyramid and over 90% demonstrating conformity to three or more of the time blocks.

Those officers with civil engineer squadron commander experience did not demonstrate a statistically significantly stronger conformity over those without civil engineer squadron commander experience. One of the factors influencing this issue is the newly enacted board process (1997) for selecting civil engineer squadron commanders. In the future, the process of screening records may strengthen the conformity of the commander group over the non-commanders.

Recommendations. As both a segmented and comprehensive model, the career pyramid appears to reflect both the sponsor's confidence in the pyramid and the empirical experience of the officer corps. The expectancy or perception of achieving the target behavior is supported because the officers have demonstrated that their effort can result in the behavior advocated by the Air Force guidance. Conversely, the instrumentality or perception of achieving the desired outcome of the Air Force guidance is not increased since demonstrating the target behavior did not result in a higher proportion of officers achieving the high-valence outcome of civil engineer squadron commander. This research recommends that the overall career guidance be kept up-to-date and reinforced. To increase the instrumentality, the Air Force guidance should be used by senior leaders as a career blueprint for both promotion and commander boards. Therefore, increasing the probability of becoming a civil engineer squadron commander by following the career pyramid will also increase the valence of that outcome.

Breadth and Depth

Conclusions. Breadth and depth are the extent and magnitude of experience within the civil engineer career field. Figure 11 of the analysis found that the vast majority of civil engineer officers started their career in a base level position. Figure 12 showed that the number of flights officers experienced in their first eight years is distributed symmetrically, averaging nearly two flights within the first eight years of service for both commanders and non-commanders. The flights found to have contained the largest officer proportions were the engineering/environmental flight category at more than 75% and nearly 50% for the operations and readiness flights for both commanders

and non-commanders. Table 25 indicates that the operations flight was the only flight for which the duty occurrences correlated to the core manning. The proportion of officers in the other flights was lower than the current core manning except for the readiness flight.

As shown in Figure 13, no more than 16% of the officers in either population clearly exhibited base level flight commander duty titles in the specified time period. More surprising, the population of non-commanders showed a statistically significantly larger proportion with base level flight commander positions compared to the commanders. Figure 14 indicates that a large majority of the populations held staff positions in the six to twelve year point as recommended by the guidance. Neither population demonstrated a statistically significantly higher proportion of staff positions in this time period. The largest proportion of officers worked on an operational command staff, almost four to one over the support command staffs. Neither population demonstrated a larger proportion with a staff position in the time period specified by the career pyramid.

Recommendations. As noted in Chapter 2, the Air Force career guidance recommends building breadth and depth by working in base level flights, becoming a flight commander, and working in a staff. The career pyramid as modeled in Figure 2 provides the time periods for these positions. In addition to this, the guidance should recommend experience in at least two base level flights in the first eight years of service. The priority flight to experience is the engineering or environmental flight. The recommendation to work as a flight commander can be dropped from the guidance unless officers are able to ensure complete clarity of their duty titles. Finally, staff work can continue to be encouraged in the suggested six to twelve year point.

These recommendations provide additional goal specificity by stating the number and type of flights to experience and the timing for staff experience. Expectancy is also enhanced since the perception of achieving the desired behavior is increased. The instrumentality, however, is weak since there is not a statistical association of the behavior to the outcome of selection for civil engineer squadron commander.

Progression

Conclusions. The guidance suggests that progression within an organization builds depth in the career. The increased responsibility of moving from operations flight commander to civil engineer squadron commander was studied for this issue. The results in Table 29 indicate that statistically more officers in the data set demonstrated this progression. Specifically, a significantly larger proportion of officers exhibited both the operations flight chief in conjunction with the civil engineer squadron commander than only exhibited the civil engineer squadron commander.

Recommendations. The Air Force guidance only suggests that progression provides officers with increased responsibility. The results of this research warrant the Air Force guidance to specifically recommend becoming an operations flight commander as a progression to becoming a civil engineer squadron commander. This recommendation increases goal specificity by specifically referencing a position in the progression to commander. The instrumentality is also increased because it is perceived as a behavior which leads to the desired outcome of civil engineer squadron commander.

Balance

Conclusions. Related to depth and breadth, the questions under balance seek to determine the proportionality of time within base level flights and in the overall career. As in the breadth and depth, the core manning in the base level flights is used as a template for the time officers should spending in them. As shown in Figure 17, the vast majority of time was spent in the engineering/environmental flight category leaving most of the other flights with sub-optimal time distributions. The readiness flight was the only flight category, which demonstrated a correspondence of time to its core officer manning according to Table 31.

As would be expected, two major position types in a career were the base level positions and staff level positions. All of the other types of positions were far less prevalent. Most of them, such as RED HORSE, career broadening and student positions are normally one-time controlled tours, limiting the amount of time an officer can spend in them. The officers studied did demonstrate a balance of time between the base level and staff level positions per Table 32. Both base level and staff level consumed about 40% of the careers studied.

Recommendations. The Air Force guidance only recommends a balanced approach to professional development. In addition to this, the Air Force guidance should recommend spending more time in the engineering and environmental flights than in any other flight at the start of a career. The guidance should also advocate spending an equal balance of time between base level and staff level positions. These recommendations will increase the goal specificity of the Air Force guidance by providing explicit objectives for balancing a career. Additionally, the expectancy is enhanced since the

empirical results demonstrate that officers can achieve the desired behavior. However, the instrumentality is weak, since career balance is not statistically associated to becoming a civil engineer squadron commander.

Overseas Tour

Conclusions. As would be expected, Figure 19 indicates that almost all of the officers had at least one overseas tour in their career. There was no difference between the proportions of the commanders and non-commanders in the proportion of officers with overseas tours. Figure 20 suggests that many officers spend up to a third of their career overseas with no difference between the commanders and non-commanders in the total amount of time spent overseas.

Recommendations. The guidance makes no specific recommendations on overseas tours. Contingent upon the number of overseas installations, the guidance should recommend that officers complete at least one overseas tour. Spending as much as a third of a career overseas may also be suggested as a legitimate option as long as the available overseas opportunities are adequate. This increases goal specificity by providing a clear objective. Expectancy also increases as long as the officers perceive the opportunity to complete an overseas tour. The instrumentality for this topic is weak since there was not a significantly larger proportion of commanders with overseas tours.

MAJCOM Experience

Conclusions. This topic evaluated the MAJCOM associated with each duty occurrence. Figure 22 shows the officers in the data set worked in as little as three MAJCOMs or as many as ten MAJCOMs in their career. The distribution across this

range was roughly symmetric and centered around six to seven MAJCOMs. However, there have been some changes in the Air Force organizational structure in the past 20 years. These changes have affected the MAJCOMs, and inflated the number of MAJCOMs associated with many of the duty occurrences. Therefore, the number of MAJCOMs will only be discussed in relation to the commander and non-commander populations. There was not a statistically significant difference between the commanders and non-commanders for the number of MAJCOMs experienced.

The time spent in each MAJCOM was analyzed by classifying each command as an operational command or support command as shown in Figure 23. Accordingly, the time spent in operational and support commands was homogeneous for the entire data set. Finally as shown in Figure 24, there was little difference in the proportion of officers that have worked in operational versus support commands.

Recommendations. The Air Force guidance suggests that experience in several MAJCOMs is related to career outcome. This analysis was unable to determine the ideal number of MAJCOMs to work in during a career. The Air Force guidance should recommend spending an equal amount of time in operational and support commands. This would increase the goal specificity since it provides an objective for time spent in MAJCOMs. Expectancy can also increase provided there continues to be opportunities in both types of MAJCOMs. The instrumentality is weak because these behaviors are not statistically related to the position of civil engineer squadron commander.

Career Broadening

Conclusions. There are limited career broadening opportunities available to civil engineer officers. There were less than 50 lieutenant colonels with experience in the identified career broadening tours in the data set as shown in Figure 25. There was not a significant difference between the commanders and non-commanders. The two most common career broadening tours were ROTC instructor or OTS instructor. Finally, Table 38 indicates a significantly larger proportion of the commander population completed their tour in the four to eight year point than in the non-commander population as recommended by the guidance.

Recommendations. The Air Force guidance suggests that there are limited career broadening opportunities and they should be completed as early as possible to remain competitive for a civil engineer squadron commander position. The analysis supports the recommendation of the guidance to complete career broadening as soon as possible to remain competitive for command positions. Therefore, the Air Force guidance should reinforce this aspect. There are also increased opportunities for career broadening which the guidance should account for. This will increase the instrumentality of the guidance since there is a relationship between this behavior and the desired outcome of becoming a civil engineer squadron commander.

Staff Positions

Conclusions. This topic investigated the staff positions held by the officers in the data set for an entire career. This is in addition to the breadth and depth evaluation of staff positions completed in a specified time period. Figure 27 show that more than 90%

of the officers studied had a staff position in their career. Neither commanders nor non-commanders had a significantly larger proportion as indicated in Table 39 and neither population spend more time in a specific staff position than another. As in the depth and breadth staff question, Figure 28 indicates the most common staff position was the operational command staff. There is some variability in the manning of the AFCESA and AFCEE staffs. The AFCESA staff has been around much longer than AFCEE and therefore contains a greater proportion of the officers in this data set. AFCEE was created in 1994 and now has a substantial number of officer authorizations. Finally, Figure 29 shows that the greatest amount of time was spent in the MAJCOM staff positions with no significant difference between the commanders and non-commanders.

Recommendations. The Air Force guidance concedes that there are many different levels of staff positions. The results indicate that the importance of staff level work should be reinforced. The guidance should specifically recommend MAJCOM staff positions and operational command staff positions should take priority over support command staff positions. These recommendations will increase goal specificity by providing a priority on staff experience. However, the instrumentality remains weak since there is not a statistical association between the recommended behaviors and the outcome of civil engineer squadron commander.

Education

Conclusions. This analysis for this topic was limited by the data, which only provided information on the in-residence education obtained by each officer. The results, as shown in Figure 29, were still significant to the findings of this research. The

commander population demonstrated a significantly larger proportion of in-residence masters degrees and in-residence Air Command and Staff College attendees than the non-commander population as indicated in Table 41. Likewise, the non-commanders had a significantly larger proportion of PhD's than did the commanders. The preponderance of PhD's in the non-commander group suggests an alternate career path not previously identified by the Civil Engineer career guidance since these officers were able to become lieutenant colonels in spite of the large proportion of time outside the mainstream civil engineer career field.

Recommendations. The Air Force guidance is not as specific as it could be about advanced degree and PME education. An in-residence master's degree and in-residence Air Command and Staff College should be recommended for those desiring to become commanders. However, independent career guidance should be provided to those officers selected to obtain an in-residence PhD since this is a clear deviation from the career path to civil engineer squadron commander. This will increase the goal specificity by making the Air Force guidance more explicit. These recommendations will also increase the instrumentality link because some aspects of officer education are associated with civil engineer squadron commanders.

Further Research

This research encountered many limitations brought on by the characteristics of the data, problems with translating the Civil Engineer Career guidance and time constraints. Following are some recommendations for future research, which will help to further reinforce and validate the Civil Engineer Career guidance.

A more valuable analysis between populations analysis could be performed by using the civil engineer squadron commander board results and comparing those selected to those not selected. This would ensure the populations more accurately reflected the experience of the civil engineer squadron commanders. Alternatively, other groups of civil engineer officers could be studied. For example, Air Force guidance can have a greater impact on current company grade officers if it is widely deployed. A more accurate and generalized translation of the career guidance could be obtained by an extensive poll of civil engineer senior leadership. The translations may provide more specific research questions for evaluation. Finally, a better understanding of the educational issues in the civil engineer career field would result from obtaining full educational records to evaluate the off-duty education.

Implications

This research has many potential benefits and applications. Many of the recommendations presented in this chapter improve goal specificity, expectancy, and instrumentality of the Air Force guidance. These improvements translate directly into enhanced performance and goal commitment for the civil engineer officer corps. Additionally, the results provide civil engineer senior leadership with a picture of the current configuration of experience among civil engineer lieutenant colonels. The methodology for this research was highly specialized and the analysis procedure may not be applicable to all career fields. However, the methods can be easily modified for employment in research efforts on other Air Force career fields.

Recapitulation

This thesis presented five chapters and an appropriate appendix. The chapters were: Introduction, Literature Review, Methodology, Findings and Analysis, and Conclusions. These chapters are briefly described below.

Chapter 1: Introduction. This chapter discussed the background, scope, and approach for the research in order to rationalize and focus the problem statement. Additionally, the research effort and direction has been scoped out along with the presentation format for the thesis document.

Chapter 2: Literature Review. The second chapter introduced the Air Force Civil Engineer career field guidance and appropriate Air Force publications. Pertinent academic literature was reviewed to construct a theoretical framework around the research. Common theories on workplace motivation were discussed and Vroom's Expectancy Theory and Goal theory were established as the most appropriate to support this research. The Air Force career guidance is referenced in Chapter 3 for the development of the research questions. The theory was used to evaluate the Air Force guidance and to focus the recommendations provided in Chapter 5.

Chapter 3: Methodology. The methodology chapter begins with the development of the research questions. The research questions translated the Air Force guidance into testable questions for analysis in Chapter 4. The latter half of the methodology chapter illustrates the categorization of the data into a manageable format. Each of the duty occurrences for each of the officers was numerically coded and entered into an Excel spreadsheet to facilitate the statistical tests performed in Chapter 4. Chapter 3 ends with an explanation of the statistical tests and the associated notation used in Chapter 4.

Chapter 4: Findings and Analysis. The fourth chapter presented the results of the data analysis. The research questions developed in Chapter 3 were addressed and analyzed to provide an objective basis for the conclusions made in Chapter 5. The procedures include graphical analyses, tests of proportion, and χ^2 tests of categorical data.

Chapter 5: Conclusions and Recommendations. The fifth chapter translated the findings in Chapter 4 into conclusions and recommendations. The recommendations are tied back to the Air Force career guidance reinforced by the theory developed in Chapter 2. The conclusions address each of the major topics introduced in Chapter 2. The results provide recommendations that improve the instrumentality, expectancy, and goal specificity of the Air Force career guidance.

Appendix. Chapter 5, Section 14 of the Air Force Career Guide

5.14. Civil Engineering Career Path. Future Air Force leaders will be comprised of those officers who demonstrate breadth and depth in their career field, show the ability to perform in high level staff jobs, to include joint positions, and prove their ability to lead. Your development as a future Air Force leader is an on-going process, and decisions made today will impact your future. It is imperative you work with your peers, supervisor, and most importantly your commander to get the best possible advice. The Air Force Assignment System (AFAS) gives you freedom in planning your future, but also the responsibility to balance Air Force needs with personal desires. Every person's career takes unique twists and turns, and there's no "school-approved solution." The key to what you'll see below--"bloom where you are planted." Do the best you can with each and every endeavor you take on, and the rest should fall into place.

5.14.1. Your commander or supervisor is available to guide and counsel you, but ultimately you must make the decisions. This career path guide should help you with those decisions. Figure 5.14 is the 32EX pyramid which shows the opportunities available at different times in the civil engineering career field. For additional information concerning civil engineer career progression, review the Civil Engineer Career Field Education and Training Plan (CFETP 32EX, Parts I, II, and III, July 1998).

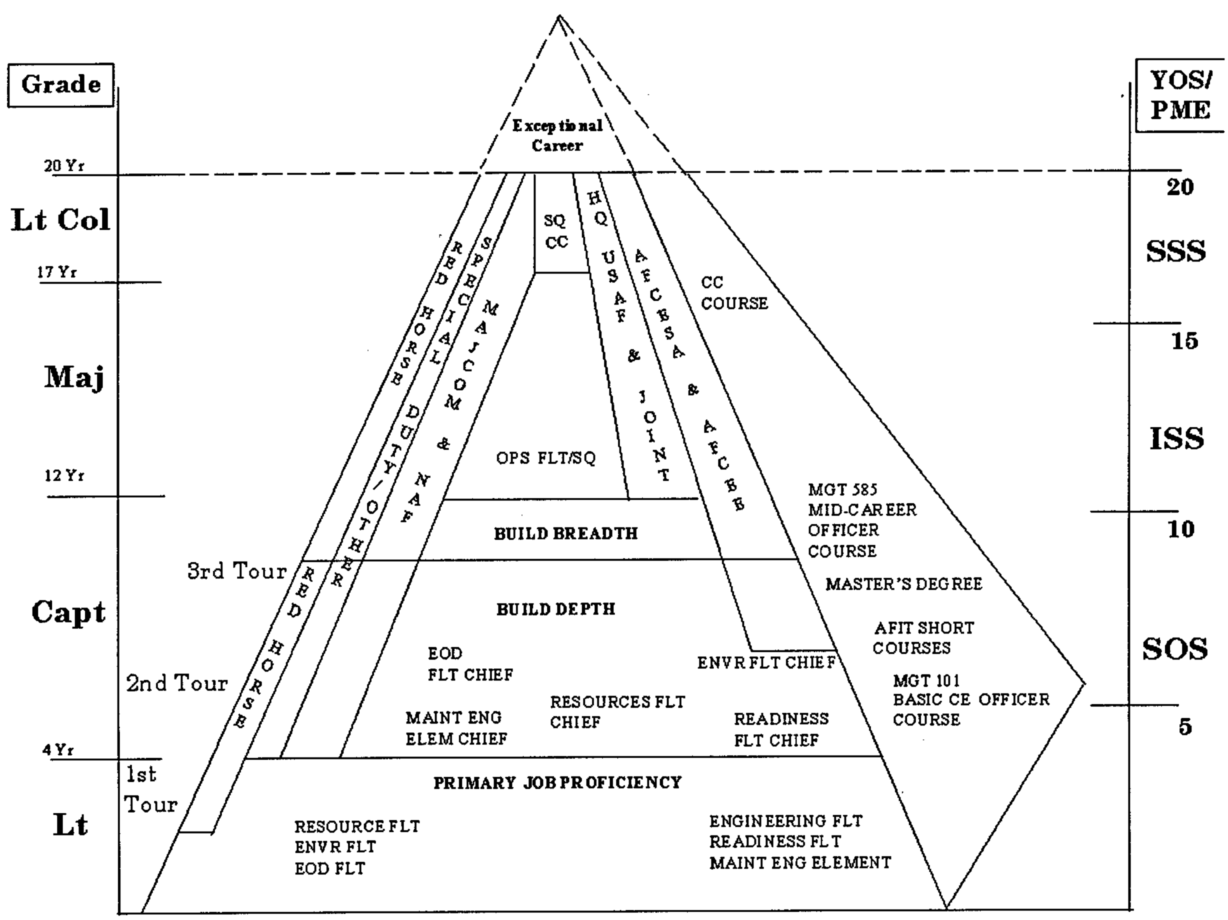


Figure 5.14. Civil Engineering Career Path Pyramid.

5.14.2. When initially assigned to civil engineering, you are expected to build depth through technical experience with increasing complexity, span of control, and responsibility. As a result of the Air Force's restructuring efforts, civil engineering was reorganized into an objective squadron. The six flights with officer authorizations are briefly described below.

5.14.2.1. The engineering flight provides cradle-to-grave responsibility for all operations and maintenance projects by contract and simplified acquisition of base engineering requirements (SABER) projects and oversight of military construction projects. Officers in this flight perform all base comprehensive planning, project programming, technical design, and construction surveillance for projects to maintain, restore, and upgrade base facilities and infrastructure systems.

5.14.2.2. Officers in the environmental flight are responsible for overseeing cleanup of hazardous waste sites, assisting the installation commander to oversee compliance with environmental laws, administering pollution prevention programs, conducting planning in accordance with the National Environmental Policy Act, and developing and managing programs for the protection of natural or cultural resources.

5.14.2.3. The readiness flight is the focal point for all contingency support and prepares the wing for operations during natural disasters, major accidents, war, and other base emergencies. Officers in this flight provide planning, program management, and training for integrated wing readiness plans, wing disaster preparedness plans, and civil engineering readiness.

5.14.2.4. The operations flight operates, maintains, repairs, and constructs installation real property with an in-house military and civilian work force. The operations flight provides the squadron's core capability and recovery or sustainability of bases for the projection of aerospace power.

5.14.2.5. The resources flight is responsible for the development, preparation, submittal, and maintenance of the financial plan, budget estimates, and the base civil engineer (BCE) financial management system. This office also serves as the BCE's focal point on all issues relating to manpower and personnel; work information management system; and real property reporting and accountability. Officers assigned to this flight should develop the resource management fundamentals necessary for their use in future leadership positions.

5.14.2.6. The explosive ordnance disposal (EOD) flight provides protection against the effects of explosive, chemical, biological, incendiary, and nuclear ordnance. Personnel assigned to this flight also conduct base populace training on ordnance recognition, hazards, and precautions. There are limited opportunities to serve in this flight, as few bases have EOD flights large enough to be led by an officer. Officers selected for EOD positions must attend specialized training before assuming these duties.

5.14.3. To experience these squadron level opportunities in sufficient breadth and depth, a minimum of two, and sometimes three, permanent change of station (PCS) moves are normally required. Breadth and depth can be gained by managing a larger or different flight or element or by assignment to a headquarters or field operating agency (FOA). When contemplating such a move, keep in mind the following:

A balanced approach to professional development--if you spent the past several years assigned to an engineering flight, then seek opportunities in another part of the organization.

Progression within a specialty provides depth and increased responsibility--such as movement from environmental officer to chief of the environmental flight.

An overseas tour--approximately 25 percent of civil engineering billets worldwide are overseas. Short tour overseas assignments offer prime opportunities to quickly fill gaps in your professional development and to hone skills in a typically austere environment.

Be mindful of the fact that experience in several different major commands (MAJCOMs) will give you a broader view of the total Air Force mission and a deeper understanding of how all the "pieces" fit together. This knowledge will lay the foundation for your future success as an Air Staff or joint staff officer.

Officers should complete Squadron Officer School (SOS) as soon as they are eligible (correspondence or residence). Eligible officers can be scheduled for SOS in-residence through two means. First, officers compete through their management levels for MAJCOM--allocated quotas. And secondly, Air Force Personnel Center (AFPC) maintains quotas for officers to attend SOS on a temporary duty (TDY) en route basis during their permanent change of station (PCS).

Air Force Institute of Technology (AFIT) offers selected officers the opportunity to pursue advanced degrees. Graduates of this program will be assigned to positions requiring their newly acquired academic specialty. Also, the base education center offers opportunities for advanced degrees through a variety of off-duty education programs.

5.14.4. The technical foundation you build early in your career will pay great dividends as a staff officer. Staff billets above the wing level for civil engineering officers are prevalent at the Air Staff and the FOAs: Air Force Civil Engineering Support Agency (AFCESA), Air Force Center for Environmental Excellence (AFCEE); in every major Air Force command; and many joint service agencies. Staff positions typically follow a three-tier hierarchy. The first tier consists of action officers who carry on the day-to-day activities of the staff. At the next level, branch chiefs (division chiefs at United States Air Force [USAF]) manage the activities of several action officers. Division chiefs (directors at USAF) then coordinate activities within their area of responsibility. And finally, bringing the entire staff together is the director (the civil engineer at USAF). Your attractiveness as a staff officer to a particular command will depend greatly on your performance and experience in that command.

5.14.4.1. There are limited staff positions a mid- to senior-level captain can choose outside the civil engineering career field for a broadening tour. These include opportunities to serve as instructors at Reserve Officer Training Corps (ROTC), Basic Military Training, Officer Training School (OTS), SOS, recruiting service, or the USAF

Academy (USAFA). Officers who choose to crossflow should do so early in their career in order to remain competitive for civil engineer commander and chief of operations jobs.
5.14.4.2. About 20 percent of those officers selected for major will be identified as candidates for resident Intermediate Service School (ISS). Many ISS students will go to a challenging joint-duty staff assignment, commander, MAJCOM, or Air Staff level job upon graduation. Officers not afforded the opportunity to attend Professional Military Education (PME) in residence should complete PME by correspondence or seminar to remain competitive in their Air Force career progression.
5.14.5. For selected officers, technical expertise, staff experience, and an outstanding performance record combine to prepare them for command. Command billets exist at several levels. Senior captains can compete for limited detachment commander positions, while more seasoned majors and lieutenant colonels can compete for traditional squadron commander positions. After a successful leadership tour, officers selected for lieutenant colonel or colonel will have the opportunity to vie for in-residence attendance at Senior Service School (SSS). Upon graduation, officers are typically assigned to a staff position (Air Staff, MAJCOM, FOAs, or joint staff). Assignments for senior lieutenant colonels also include opportunities to serve as a MAJCOM division or branch chief, or as a deputy support group commander. Following this tour, leadership opportunities as a group commander, MAJCOM director, MAJCOM/FOA director or deputy, and Air Staff director become available.
5.14.6. This narrative does not suggest that all civil engineering officers need to strive to be "the civil engineer" or that there is only one ideal path to that level. However, the path to that level normally includes a strong technical base, squadron command, and a MAJCOM and Air Staff tour. Whatever your goals, the often-used phrase still holds true: How well you do in your current job is the most important factor in determining your future success.

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Vita

Captain Travis K. Leighton was born on 25 November 1972 in Limestone, Maine. He graduated from Limestone High School in 1991. He was accepted to study undergraduate Civil Engineering at the University of Illinois in Champaign-Urbana, Illinois where he graduated in 1995. He was commissioned through the Detachment 190 AFROTC at the University of Illinois where he was recognized as a Distinguished Graduate and nominated for a Regular Commission.

His first assignment was at Ellsworth AFB, South Dakota as a design civil engineer in January of 1996. In 1997, he became the chief of construction management at Ellsworth where he oversaw all contracted construction at the installation. While stationed at Ellsworth, he deployed three months in support of Joint Task Force Bravo in Soto Cano Air Base, Honduras in 1996. In 1997, he deployed for two months as part of a humanitarian construction team, Camp Fair Winds, Haiti in support of Exercise New Horizons. Also in 1997, Captain Leighton was selected to deploy for two weeks to Prince Sultan Air Base, Saudi Arabia as part of a planning assistance team for the relocation of key maintenance facilities. Upon graduation, he will be assigned to Malmstrom AFB, Montana.

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